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TRANSACTIONS

OF THE

EPPING FOREST AND COUNTY OF ESSEX NATURALISTS' FIELD CLUB.

(ESSEX FIELD CLUB.)

VOL. II.

TRANSACTIONS

OF THE

EPPING FOREST & COUNTY OF ESSEX NATURALISTS' FIELD CLUB.

(ESSEX FIELD CLUB.)

EDITED BY THE HONORARY SECRETARY.

VOLUME II.

FEBRUARY 26TH, 1881, TO JANUARY 28TH, 1882.

THE AUTHORS ONLY ARE RESPONSIBLE FOR THE STATEMENTS AND OPINIONS CONTAINED IN THEIR RESPECTIVE PAPERS.

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BUCKHURST HILL, ESSEX.

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APPENDIX.

REPORT OF THE COUNCIL AND BALANCE SHEET FOR 1881;

CATALOGUE OF THE LIBRARY;

LIST OF MEMBERS, &c.

Corrected to March 25th, 1882.

ESSEX FIELD CLUB,
BUCKHURST HILL.

Dr. Treasurer's Statement of Account for the Year ending December 31st, 1881. *Cr.*

	£	s.	d.	£	s.	d.
To Balance from 1880	54	16	2			
Less Life Compositions carried to separate account	36	15	0			
				18	1	2
,, Subscriptions, 1880	2	17	0			
,, ,, 1881	121	11	6			
,, ,, 1882	7	5	6			
				131	14	0
,, Receipts at Lecture				14	2	0
,, Donations to Publication expenses				3	10	0
,, Sale of Publications				4	2	10
,, Receipts at Field Meetings				43	0	0
				£214	10	0

	£	s.	d.	£	s.	d.
By Lecture Expenses				11	11	0
,, Postages				23	1	10
,, General Expenses:—						
Printing Notices, Tickets, &c.	7	19	6			
Stationery	3	7	6			
Sundry Expenses	2	5	1			
				13	12	1
,, Expenses of Field Meetings				48	8	5
,, ,, Museum and Library—Binding, &c.				15	1	4
,, Printing 'Transactions'				72	16	5
Balance in hand				29	18	11
				£214	10	0

Life Composition Account.

	£	s.	d.	£	s.	d.
To Seven Compositions received in 1880				36	15	0
,, Three ,, ,, 1881				15	15	0
				£52	10	0

	£	s.	d.	£	s.	d.
By Furniture and Fittings for Library and Museum				33	4	6
Balance				19	5	6
				£52	10	0

Forest Camps Exploration Fund.

	£	s.	d.	£	s.	d.
To Subscriptions received to date				45	12	0
				£45	12	0

	£	s.	d.	£	s.	d.
By Expenses of Excavating				22	10	0
,, Sundry Expenses				17	10	10
Balance				5	11	2
				£45	12	0

Summary.

	£	s.	d.
Balance in hand	29	18	11
Unpaid Subscriptions	21	16	6
Balance of Life Compositions	19	5	6
,, Camp Fund	5	11	2

	£	s.	d.
Estimated Liabilities	38	0	0

Examined and found correct,

R. L. BARNES,
Treasurer pro tem.

January 27th, 1882.

R. LETCHFORD.
N. F. ROBARTS. } *Auditors.*

REPORT OF THE COUNCIL FOR THE YEAR 1881.

[Read at the Second Annual General Meeting, held at Buckhurst Hill, January 28th, 1882.]

The Council has great pleasure in announcing the continued and increasing prosperity of the Essex Field Club since its formation in January, 1880. Enthusiastic views as the future of the Society were often met by gloomy forebodings as to the difficulties of steering such an association through the the second year of its existence, when the attraction of novelty had perhaps worn off before any real and lasting work had been accomplished, and before the Society had earned its title to respect and to steady and hearty support. It may safely be asserted that the Club has left such dangers well in its wake, or rather that it has never encountered them; and the rapid increase in its numbers and the intelligent interest taken in its proceedings have been constant and very gratifying experiences during the year 1881.

Since the last Report (which gave a summary of the work of the Society up to 31st December, 1880), 102 ordinary members and 5 honorary members have been elected, of whom 3 have compounded for their annual subscriptions; 14 members have resigned; 1 has been removed for non-payment of subscription, and the Council records with great regret the loss of two original members by death—Sir Antonio Brady and Mr. Walter Weston. Short obituary notices of these gentlemen will be given by the President in his annual address.

The census of the Club at the end of the years 1880 and 1881 was therefore as follows:—

	1880.	*1881.*
Honorary members	4	9
Life members	7	10
Ordinary members.....	213	295
	224	314

Showing a net increase of 90 members during the past year. This result may be taken as an index of the rapid rise of the Club in public esteem, and there seems to be no reason for believing that the supply of candidates for admission into the Society is exhausted. Satisfactory as the roll now is, the annual income is not enough to publish well-illustrated 'Transactions' to the full extent desired—an increase of (say) 100 subscribers to the funds of the Club would enable the Council to print half

or two-thirds more matter, and so give each individual member a higher return for his or her subscription than at present, while the Society would more thoroughly fulfil one of its most useful and permanently valuable functions. An inspection of the list of members will show that the Club is surely, although perhaps somewhat slowly, making its way among the inhabitants of parts of Essex remote from the head-quarters. All well-wishers of the Society will desire to see this class of members largely increased. The Club should have representatives in every parish in the county, and remembering the very small subscription asked from members living outside the radius of 15 miles from head-quarters, it is manifest that such members will eventually receive even more than a fair equivalent in the shape of publications for their expenditure.

A deputation, consisting of the President and Treasurer, and Mr. John Spiller, waited upon Mr. Parkes, the Chairman of the Great Eastern Railway Company in July last, when the latter very kindly granted the important concession as to fares payable by members attending the meetings, which has been taken advantage of on many occasions, and which cannot fail to be of great utility both to the Society and to the members. The best thanks of the Society are due to the Directors for their kindness, and to Mr. J. Robertson, Superintendent of the line, for his many courtesies in connection therewith.

Three parts of the 'Transactions' have been published during the year, comprising (with the reprinted rules and list of members) 188 pages of letterpress, and six plates, one being coloured. The Council early saw the necessity of the 'Transactions' being sent out by an experienced printer, and the two parts produced by Messrs. West, Newman, & Co. leave little to be desired as regards appearance and general accuracy. The desire of the Editor has been to give full and faithful records of the popular as well as of the scientific work of the Society,—how far this desire has been fulfilled it is for our critics to decide. As intimated in the account of the Grays Meeting, the Society is indebted to our President and to our members Messrs. J. Spiller and G. C. Harcourt for the autotype plate accompanying that report, and the special thanks of the Council and members are due to our honorary member, Major-General Pitt-Rivers, for his generous donation of £12 to defray cost of the chromo-lithographed plate of the objects found in the rampart of Ambresbury Banks.

The attendances at the meetings have been good, in spite of unfavourable weather on several occasions. Twelve ordinary meetings have been held during the year, at which 420 members have been present, giving an average of 35, with 102 visitors. Six field meetings were organised, 224 members having attended, or an average of 37, about 130 visitors having also been present. Three field meetings were held in conjunction with other Societies—the Geologists' Association, the Hertfordshire Natural History Society, and with the subscribers to the Essex and Chelmsford

Museum. The best thanks of the Club are due to the following gentlemen, who, in the kindest way, gave their valuable services as "conductors" at these meetings:—G. H. Birch, Esq., F. Chancellor, Esq., Professor Morris, Henry Walker, Esq., T. Fisher Unwin, Esq., W. Saville Kent, Esq., Professor Boulger, Dr. Cooke, Worthington G. Smith, Esq., Dr. Wharton, Mr. James English, Dr. Braithwaite, and E. M. Holmes, Esq. On the occasion of the visit to Chigwell, on June 25th, the members were most hospitably entertained at Oakhurst, by the Rev. W. Linton Wilson and Mrs. Wilson. The Rt. Rev. the Lord Bishop of St. Alban's kindly gave the Club permission to wander through the grounds and woods of Danbury Palace, and we have to thank the Rev. James Francis for permission to meet in his school room at Waltham, Rev. R. H. Brenan for a similar courtesy at Grays, and T. W. Wakefield, Esq., T. M. Gepp, Esq., Rev. T. P. Bridges, Edmund Durrant, Esq., Dr. Priest, Hy. Corder, Esq., and many other gentlemen, for aid afforded in organising these excursions. The Council also desires to thank the editors of the following newspapers, who have published from time to time reports of the meetings, and in other ways contributed to the success of the Club by making it widely known throughout the county:—The 'Essex Times,' 'Chelmsford Chronicle,' 'Essex Weekly News,' 'Essex Herald,' 'Waltham Abbey Telegraph,' and 'Woodford Times.'

After the careful report of General Pitt-Rivers, and the details given in the 'Proceedings,' but little remains to be said respecting the excavation at Ambresbury Banks. The Council cannot but congratulate the members on the good results which were obtained from the first scientific investigation undertaken by the Club. The success of such researches, of course, mainly depends upon the skill and care with which they are planned and conducted. The Society was particularly fortunate in enlisting the co-operation of an eminent and experienced Archæologist in the work. General Pitt-Rivers took a lively interest in the exploration throughout, and the Council cannot too strongly emphasise its deep sense of the value of his ready aid and sympathy. To Mr. D'Oyley also hearty acknowledgments are due. He took the greatest possible care in the matter, and was always ready to render all the help in his power. Mr. D'Oyley has kindly offered to act on future occasions as the Honorary Surveyor to the Club. The thanks of the Society should also be rendered to those gentlemen who, at considerable expenditure of time, attended as watchers at the excavations, and so rendered possible an accurate account of the objects found. The Council proposes to commence work upon the Loughton Camp as early as practicable in the spring, and also, if possible, to make further researches at Ambresbury in order to clear up some doubtful points. Of course, considerable funds will be required, and the Council confidently asks for liberal contributions towards a work, the successful accomplishment of which cannot fail to be of great advantage to the Club, as well of very considerable interest not only to members, but to all who take a pleasure in the discovery of reliable information

respecting the early history of the county and the wider questions involved in the facts which are gradually being revealed by means of such methods of inquiry concerning the non-historic periods in the life of the human race.

At the York meeting of the British Association the following members of the Club were honoured by being appointed a Committee to report upon this Loughton earthwork:—General Pitt-Rivers, Mr. R. Meldola, and Mr. W. Cole (Secretary). The Council can only hope that the second work may be at least as successful as the first, and that the Committee may be enabled to present a satisfactory report at the Southampton Congress of the British Association.

The Library has been growing steadily during the year, and it speaks well for the generosity of the members that almost all the books upon the shelves have been gratuitously presented, the only exceptions being a few volumes of 'Transactions,' &c., which have been acquired by exchange or purchase. The numerous scientific periodicals also which month by month have been laid upon the Library table, we owe to the kindness of several members, four of these journals only being received in return for the 'Transactions' of the Club. The Council recommends to the members generally this convenient method of benefitting the Society. There seems to be no reason why the Reading Room should not, in this way, be constantly supplied with the best periodical literature of science without any charge upon the general funds. The Librarian will be most happy to give information and advice to any one who may wish to act upon the suggestion in the future.

That the Club is beginning to take an honourable position among the older scientific Societies throughout the country is evidenced by a reference to the list of those with which it exchanges publications. The Council takes this opportunity of acknowledging the readiness with which the request to become thus associated has been responded to. The object in view has been to open relations with the leading Society in each county, and it is proposed to judiciously extend the "Exchange List" to counties which are still unrepresented, as opportunities may arise. In thickly populated districts it has been found desirable to include two or more Societies in the scheme, the subjects of study being more specialised than is the case in agricultural counties. The policy of presenting the 'Transactions' to the London Chartered Societies and a few of the chief scientific journals will be continued, but in no case will the number of copies presented or exchanged be allowed to exceed 100. A list of Societies, &c., to which publications are presented is appended to this report.

The number of books borrowed during the year has been very small, but it is hoped that as the Library increases in value and extent, the members will recognise the advantage of using it more frequently. A catalogue is in preparation, and when issued it will no doubt stimulate the circulation of the volumes, which at present number 150.

The heartiest thanks of the Club are due to those who have kindly presented books, pamphlets, periodicals, &c., and whose names will be found from time to time in the 'Journal of Proceedings.' Some of the volumes are of considerable and increasing value, and it is only necessary to add that the greatest possible care will be taken of all works entrusted to the keeping of the Librarian, who hopes to have a busy year in receiving additions to the Library, and circulating them among the members.

The Museum has also made some progress, although the additions to it have not been so numerous as to the Library. Early in the year the Council voted a sum of £36 15s. towards fitting up the rooms. About £33 of this amount has been so expended, but before much can be done in the very desirable work of collecting a series of the natural productions of Essex, a very considerable sum must be expended in the purchase of cabinets and cases. Attention has been more than once drawn to this matter at the meetings of the Society, and we have the benefit of a paper by Mr. Harting, which very clearly points out the line we should take and the methods to be employed in establishing a local museum. The Council must impress upon the members the desirability of aiding in every way in their power the growth of the collections. In this work almost every one can help, with but a small expenditure of money, and it may be pointed out to beginners and novices that no surer method is possible of acquiring a definite and useful knowledge of natural history than by judiciously collecting specimens under the guidance of some more advanced student in the same department. It is intended to issue some detailed instructions as soon as possible. Pressure of other matters connected with the Society has delayed the appearance of these hints, but it is hoped that they will be issued by the summer, and that an immediate result will be apparent in the extent of the Museum treasures.

The finances of the Society are not quite so satisfactory as could be wished, owing mainly to the number of subscriptions still unpaid. In the great majority of cases, no doubt, this neglect of the first duty members owe to the Society is the result of thoughtlessness, but the Council cannot too strongly appeal to the backward members to remedy this state of things. The repeated sending out of letters of application entails considerable expense, which is so much money wasted, and a more serious consequence is that non-compliance with the rule that *all subscriptions are payable in advance on January 1st in each year* throws upon the officers of the Society an amount of irksome and very unpleasant work, which it is not right that they as volunteers should be called upon to perform. Ill-health, necessitating an absence from England during the winter months, obliged Mr. H. J. Barnes to resign his office as Treasurer in the autumn. To Mr. Barnes, as its first Treasurer, the Society owes its best thanks, and the Council is sure that the members generally will echo the wish that he may return in the spring completely restored to health. Mr. R. L. Barnes very kindly undertook to act as Treasurer

until the general meeting, and the Council begs gratefully to acknowledge his valuable services.

The President attended the Conference of Scientific Societies held at York during the meeting of the British Association, as one of the delegates of the Essex Field Club. Little was done beyond appointing a Committee to take steps to have the Conference of Delegates recognised by the Council of the British Association, and resolving that a circular should be sent to the various local Societies, pointing out the work undertaken by the Committees of the Association, and the valuable aid which might be given by these Societies in that and other scientific work.

The thanks of the Society are again due to Miss Jane Cole and Mr. H. A. Cole for the use of rooms for meetings, and also for the sole use of the two rooms used as a library and museum.

LIST OF SOCIETIES, ETC., TO WHICH THE 'TRANSACTIONS' ARE PRESENTED.

Aylesbury, Buckinghamshire Architectural and Archæological Society.
Belfast Natural History and Philosophical Society.
——— Naturalists' Field Club.
Berwickshire Naturalists' Club.
Birmingham Natural History and Microscopical Society.
Bristol Naturalists' Society.
Bury St. Edmunds. Suffolk Institute of Archæology and Natural History.
Cambridge Philosophical Society.
——— University Library.
Canterbury. East Kent Natural History Society.
Cardiff Naturalists' Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History and Microscopical Society.
Colchester. Essex Archæological Society.
——— Natural History Society.
Devizes. Wiltshire Archæological and Natural History Society.
Dublin. Royal Geological Society of Ireland.
———. Trinity College Library.
———. University Biological Association.
Dulwich College Science Society.
Dumfries-shire and Galloway Scientific, Natural History and Antiquarian Society.
Eastbourne Natural History Society.

Edinburgh. Advocates' Library.
——— Botanical Society.
——— Geological Society.
Glasgow, Geological Society of.
———, Natural History Society of.
———, Philosophical Society of.
Hackney Microscopical and Natural History Society.
Hereford. Woolhope Naturalists' Field Club.
Huddersfield. Editors of 'Naturalist.'
Leeds. Editor of 'Journal of Conchology.'
———. Yorkshire Naturalists' Union.
Leicester Literary and Philosophical Society.
Lewisham. West Kent Natural History, Microscopical, and Photographic Society.
Liverpool Geological Society.
——— Literary and Philosophical Society.
——— Naturalists' Field Club.
London and Middlesex Archæological Society.
London. Anthropological Institute of Great Britain and Ireland.
———. British Museum.
———. Entomological Society,
———. Geological Society.
———. Geologists' Association.
———. Guildhall Library.
———. Linnean Society.
———. Quekett Microscopical Club.
———. Royal Microscopical Society.
———. Royal Society.
———. Scientific Club.
———, South, Entomological Society.
———, West, Scientific Association.
———. Zoological Society.
———. Editor of 'Annals and Magazine of Natural History.'
———. ,, 'Antiquarian Magazine.'
———. ,, 'Antiquary.'
———. ,, 'Field.'
———. ,, 'Gardeners' Chronicle.'
———. ,, 'Gardeners' Magazine.'
———. ,, 'Geological Magazine.'
———. ,, 'Grevillea.'
———. ,, 'Journal of Botany.'
———. ,, 'Land and Water.'
———. ,, 'Nature.'
———. ,, 'Popular Science Review.'
———. ,, 'Science Gossip.'
———. ,, 'Scientific Roll.'
———. ,, 'Zoologist.'

Manchester Field Naturalists' and Archæologists' Society.
——— Geological Society.
——— Literary and Philosophical Society,
Newcastle-on-Tyne. Tyneside Naturalists' Field Club.
Newcastle, Staff. North Staffordshire Naturalists' Field Club.
New Cross Microscopical and Natural History Society.
Norfolk and Norwich Naturalists' Society.
Northampton Natural History Society.
Norwich Geological Society.
Nottingham Literary and Philosophical Society.
Ottawa Field Naturalists' Club.
Oxford. Bodleian Library.
Perthshire Society of Natural Science.
Plymouth Institution and Devon and Cornwall Natural History Society.
Salem, Mass. Essex Institute.
Sherborne. Dorset Natural History and Antiquarian Field Club.
Stroud. Cotteswold Naturalists' Field Club.
Taunton. Somersetshire Archæological and Natural History Society.
Truro. Royal Institution of Cornwall.
Walthamstow Microscopical and Natural History Society.
Watford. Hertfordshire Natural History Society and Field Club.

CATALOGUE OF THE LIBRARY.

LIBRARY REGULATIONS.

1.—Books may be borrowed by Members only, on application to the Librarian, at such times as the Rooms occupied by the Society are open to Members.

2.—The title of every book borrowed shall be entered in the Library Register, with the signature of the borrower.

3.—No Member may borrow more than one volume at a time, without the permission of the Council, and certain books (marked thus * in the Catalogue) may only be consulted at Head-quarters.

4.—No book may be retained longer than one month, but a Member may borrow the same volume for a further period, if no other application for it be made.

5.—All books shall be returned at the last Ordinary Meeting of each Session, and the issue shall not be resumed until the first Ordinary Meeting of the following Session.

6.—No map, plate, drawing, manuscript, or unbound publication, may be borrowed without the permission of the Council, but current numbers of periodicals, transactions, &c., will be laid upon the Library table, and back numbers of the same may be referred to on the premises, if necessary.

7.—Any Member failing to return a book on the application of the Librarian, or returning a book damaged or defaced, shall be liable for its value; and if it form part of a work, for the value of the whole work rendered imperfect.

*Books marked thus * do not circulate.*

Adams, H. G. Beautiful Butterflies. 8vo. London. [N. D.]

American Entomologist. 2nd series. 8vo. New York, 1880.

Anon. [Defoe.] The History of the Great Plague in London. [Containing references to Epping Forest.] 8vo. London, 1832.

Anon. English Forests and Forest Trees, Historical, Legendary, and Descriptive. 8vo. London, 1853.

Anon. ("Stonehenge.") British Rural Sports. 14th edition. 8vo. London, 1878.

Anon. The Wild Flowers of Repton. 8vo. London, 1866.

Antiquarian Itinerary. 3 vols. 8vo. London, 1815—16.

Archæological Institute of Great Britain and Ireland. Memoirs illustrative of the History and Antiquities of Wiltshire and the City of Salisbury. 8vo. London, 1851.

Berkeley, Rev. M. J. Fungi. *See* Cooke, Dr. M. C.

Bingley, Rev. W. Memoirs of British Quadrupeds. 8vo. London, 1809.

Botany, Journal of. New series. Vol. x. 8vo. London, 1881.

Bowerbank, J. S. A History of the Fossil Fruits and Seeds of the London Clay. 8vo. London, 1840.

Brady, Sir A. *See* Davies, William.

Brightwell, Miss. A Life of Linnæus. 8vo. London, 1858.

*Britton, John. The History and Description of Cassiobury Park, Hertfordshire, the Seat of the Earl of Essex. Folio. London, 1837.

Brown, Capt. T. The Book of Butterflies and Moths. 16mo. London, 1843.

———. *See* White, Rev. G.

Buckinghamshire Architectural and Archæological Society. Records of Buckinghamshire. Vols. iii.—iv. 8vo. Aylesbury, 1870.

Buckland, Frank. Curiosities of Natural History. 2nd series. 12mo. London, 1860.

———. The Natural History of British Fishes. 8vo. London, 1880.

Buckler, G. Twenty-two of the Churches of Essex, architecturally described and illustrated. 8vo. London, 1856.

Buffon. The Natural History of Quadrupeds. 8vo. London, 1804.

Chichester and West Sussex Natural History and Microscopical Society. Reports and Papers. 8vo. Chichester, 1877—82.

Coleman, Rev. W. H. Flora Hertfordiensis. *See* Webb, Rev. R. H.

Cooke, G. A. Topographical and Statistical Description of the County of Essex. 24mo. London. [1802—10.]

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Mar. 26, 1881. Cory, Frederic, M.D., L.R.C.P., M.R.C.S., F.R.G.S., "The Elms," Buckhurst-hill.
Apl. 30, 1881. Cory, F. W., M.R.C.S., L.S.A., F.M.S., "The Elms," Buckhurst-hill.
* Crisp, Frank, LL.B., B.A., F.L.S. (*Secretary to the Royal Microscopical Society*), M.E.S., 5, Lansdowne-road, Notting-hill, W.
Mar. 25, 1882. Croft, Richard B., Retired Lieutenant R.N., F.L.S., F.R.M.S. (*Hon. Secretary, Hertfordshire Nat. Hist. Soc.*), Fanham's Hall, Ware, Herts.
* Crouch, Henry, F.R.M.S., Grove-hill, Woodford.
Aug. 28, 1880. Crouch, Walter, Grafton-house, Wellesley-road, Wanstead.
Sep. 25, 1880. Cutting, William M., Elm-house, Loughton.
Mar. 25, 1882. Day, George, 12, The Mount, Whitechapel, E.
* Deacon, Octavius, Golding's-hill, Loughton.
* Devitt, Henry, Hillside, Buckhurst-hill.
Nov. 26, 1881. Douglas, James, Lexford-cottage, Ilford.
* D'Oyley, William, Honorary Surveyor, Loughton.
* Duffield, Frederick H., 78, Claverton-street, Pimlico, S.W.
*† Dunning, J. W., M.A., F.L.S., F.Z.S., 12, Old-square, Lincoln's-inn, W.C.
Aug. 13, 1881. Durrant, Edmund (*Hon. Sec. Chelmsford Museum*), High-street, Chelmsford.
* Durrant, W. G., Whitehall-road, Woodford.
Mar. 26, 1881. Edinger, W. H., "Rocklands," Palmerston-road, Buckhurst-hill.
Aug. 13, 1881. Emanuel, Frank L., 22, St. Stephen's-square, Bayswater, W.

* Emery, W. Francis, 104, Liverpool-road, Islington, N.

* English, James, Epping.

Aug. 28, 1880. Essex, The Right Hon. the Earl of, Cassiobury Park, Watford, Herts.

Aug. 28, 1880. Fawcett, William, Fern-villa, Maybank-road, Woodford.

May 29, 1880. Finzi, John, 105, Gower-street, W.C.

* Fisher, Lionel P., South-side, Harrow, Middlesex.

Aug. 28, 1880. Fisher, William R., M.A., Barrister-at-law, South-side, Harrow, Middlesex.

* Fitch, Edward A., F.L.S. (*Secretary to the Entomological Society*), Vice-President, Brick-house, Maldon.

* Forbes, William P., Evergreen-lodge, Wanstead.

* Forster, William, East Lenham-lodge, Cleveland-road, Wanstead.

Aug. 13, 1881. Forward, F. H., Stanford-le-Hope.

* Fowler, William, J.P., Forest-house, Leytonstone.

* Francis, Rev. James, M.A., Vicarage, Waltham Holy Cross.

* Francis, William, Ph.D., F.L.S., F.G.S., F.C.S., F.R.A.S., Red Lion-court, Fleet-street, E.C.; *and* The Manor-house, Richmond, Surrey.

July 24, 1880. Friswell, Richard J., F.C.S., F.I.C., 10, Clapton-square, Lower Clapton, E.

June 25, 1881. Gardner, Percy, M.A., F.S.A. (*Disney Professor of Archæology, Cambridge*), 4, Whitehall-lane, Woodford.

* Gardner, Samuel, 5, Whitehall-lane, Woodford.

* Gardner, Thomas, Oak-lea, Whitehall-road, Woodford.

May 29, 1880. Gawler, John M., Spencer-house, Atherton-road, Forest-gate.

Aug. 28, 1880. George, William, 19, Church-crescent, South Hackney, N.E.

* Gibbs, John, Writtle-road, Chelmsford.

May 28, 1881. Gibson, George Stacey, F.L.S., Saffron Walden.

May 29, 1880. Glass, Charles J., Bocking-house, Walthamstow.

* Godwin, George J., 4, St. John's-villas, Buckhurst-hill.

* Godwin (Mrs.), 4, St. John's-villas, Buckhurst-hill.

* Gomm, William H., The Green, Somerton, Somerset.

* Gordon, Frederick, Bentley-priory, Great Stanmore, Middlesex.

* Goss, Herbert, F.L.S., F.G.S., M.E.S., The Avenue, Surbiton-hill, Surrey.

Feb. 25, 1882. Gould, Chalkley, Traps-Hill-house, Loughton.

* Gould, F. C., 10, Knighton-villas, Buckhurst-hill.

Aug. 13, 1881. Gould, George W., Champion's-hill, Loughton.

Dec. 17, 1881. Green, R. R., Clifton-cottage, Cleveland-road, Snaresbrook.

*Grut, Ferdinand, F.L.S. (*Librarian to the Entomological Society*), 9, King-street, Southwark, S.E.

Feb. 25, 1882. Gurney, J. H. (Jun.), F.Z.S., Northrepps-hall, Norwich.

Sep. 24, 1881. Halford, Bernhard F., B.Sc., &c., 26, Cleveland-gardens, Hyde-park, W.

* Halsey, William, 3, Mornington-road, Woodford.

* Harcourt, George C., 34, Wellesley-road, Wanstead.

Oct. 1, 1881. Harold, Frederick R., F.S.S., 19, Lambton-road, Hornsey-rise, N.

* Harper, Augustus, Lomsenheim, Cleveland-road, Wanstead.

Mar. 26, 1881. Harrison, Francis G., Crown-hotel, Loughton.

* Hart, F. G., Canes, near Harlow.

Feb. 25, 1882. Harwood, W. H., Colchester.

* Heath, Francis G., Brunswick Lodge, South Hackney, N.E.

July 24, 1880. Heathfield, Ernest, Snakes-lane, Woodford,

Oct. 1, 1881. Hempleman, F. H., Cleveland-lodge, Wanstead.

* Henty, Robert, Nazing-park, Waltham Cross.

* Hodge (Miss), Catherine L., Magdala-house, Buckhurst-hill.

* Hodge (Miss), Mary, Magdala-house, Buckhurst-hill.

* Hodge, Samuel W., Magdala-house, Buckhurst-hill.

* Hooper, Basil M., 2, Albert-villas, Whitehall-road, Woodford.

* Hooper, Horace B., Roden-house, Abridge.

* Hore, J. P., 40, Bloomsbury-street, Bedford-square, W.C.

* Howard, David, F.C.S. (*President of the Walthamstow Nat. Hist. Soc.*), Rectory-manor, Walthamstow.

* Howard, John Eliot, F.R.S., F.L.S., Lord's Meade, Tottenham, N.

* Howard, William C., North-side, Tottenham, N.

* Howard, W. Dillworth, City Mills, Stratford.

Apl. 30, 1881. Hughes, Rev. Albert, M.A., The Rectory, Woodford.

* Hutchinson, John, Fairlight, Palmerston-road, Buckhurst-hill.

Feb. 26, 1881. Hutchinson, Richard, Woodford Wells.

* Hutchison, W. D.

Sep. 25, 1880. Hutchison, W. E., 9, Hill-street, Clapton, E.

June 25, 1881. Jackson, Rev. E. S., Buckhurst-hill.

Oct. 1, 1881. James, F. J. Vallance, 82, Cambridge-street, Eccleston-square, W.

Dec. 18, 1880. Jervoise, Sir J. Clarke, Bart., Idsworth-park, Horndean, Hants.

* Johnston, Andrew, J.P., D.L., &c. (*Verderer of Epping Forest*), Honorary Treasurer, The Firs, Woodford.

Aug. 28, 1880. Jones, D. B., Elm-view, Middle-lane, Hornsey, N.
Oct. 1, 1881. Jones, George T., M.D., The Laurels, Loughton.
Sep. 25, 1880. Kell, E. Delacourt, Holland-house, Spring-grove, *near* Isleworth.
* Kelly, Alexander, Sprigg's Oak, Epping.
* Kelly (Mrs.), Sprigg's Oak, Epping.
* Kelly (Miss), Catherine, Aubrey-house, Woodford.
* King, Joseph E. S., 16, North-buildings, Finsbury-circus, E.C.
* King (Mrs.), 37, Arundel-square, Barnsbury, N.
Apl. 30, 1881. King, Thomas, Westbury-house, Buckhurst-hill.
* Kingdon, Rev. H. J., M.A.
June 25, 1881. Latter, W. J., Mus.B., R.A.M., Woodford.
Feb. 25, 1882. Laver, Henry, M.R.C.S., F.L.S. (*Hon. Sec. Colchester Nat. Hist. Soc.*), Colchester.
Apl. 30, 1881. Lawson, James W., 104, Shrubland-grove, Dalston, E.
Sep. 24, 1881. †Leaf, Charles J., F.L.S., F.G.S., F.R.M.S., F.S.A., Old Change, E.C., *and* Pain's-hill, Cobham, Surrey.
Aug. 28, 1880. Leeman, Rev. Alfred, M.A., Starling-lodge, Buckhurst-hill.
* Letchford, R., F.R.M.S., Prospect-house, Woodford.
* Lindsay, R. B.
* Lister, Arthur, J.P., F.L.S., Leytonstone.
Mar. 26, 1881. Livingston, Clermont, M.E.S., East-lodge, Forest-rise, Walthamstow.
Apl. 30, 1881. Locket, George C., Highwood-house, Mill-hill, Hendon, Middlesex.
* Lockyer, Alfred, Honorary Librarian, Stanley-road, Woodford.
* Lockyer, Bernard, 33, Freegrove-road, Holloway, N.
Nov. 27, 1880. Lockyer, F. T., Raleigh, North Carolina, United States.
* Lockyer, G. H., Tavistock-road, Snaresbrook.
Aug. 13, 1881. Lowndes, George Alan, M.A., J.P., D.L., Barrington Hall, Hatfield Broad Oak, *near* Harlow.
* Lubbock, Sir John, Bart., D.C.L., LL.D., M.P., F.R.S., F.G.S. (*President British Association*), High Elms, Farnborough, Kent.
May 28, 1881. Macdonald, D. G. F., J.P., LL.D., C.E., 61, Hugh-street, Eccleston-square, S.W.
* Mackmurdo, Walter George, Beechmont, Palmerston-road, Buckhurst-hill.
July 24, 1880. Mackonochie, William, St. Mary's Hospital, Paddington.
Apl. 30, 1881. Maitland, Rev. A. Gray, F.R.G.S., Church-end, Woodford.
* Makins, Colonel, M.A., M.P., J.P., D.L., Prince's-gate, S.W.
Sep. 24, 1881. Marshall (Mrs.), Epping New-road, Buckhurst-hill.

Oct. 1, 1881. Marsham, Charles A. Onley, J.P., Sandon, *near* Chelmsford.

Aug. 28, 1880. Martin, Edward, B.A., Barrister-at-law, F.Z.S., Union Bank Chambers, Carey-street, Lincoln's-inn, W.C.

July 24, 1880. Martin, Walter E., 3, Mornington-villas, Mornington-road, Woodford.

Feb. 25, 1882. Mawer, Walter, F.G.S., 37, Norfolk-street, Strand, W.C.

* McKenzie, Alexander (Captain Hon. Artillery Company), *Superintendent of Epping Forest*, Warren-house, Loughton.

* McKenzie, John A., F.R.M.S., Ferrestone-lodge, Hornsey, N.

Sep. 24, 1881. Meggy, F. H., Chelmsford.

June 25, 1881. Meldola (Mrs.), 21, John-street, Bedford-row, W.C.

* Meldola, Raphael, F.R.A.S., F.C.S., M.P.S., F.I.C., &c., President, 21, John-street, Bedford-row, W.C.

*† Melles, William, F.L.S., Sewardstone-lodge, Sewardstone.

* Miall (Miss), Darwen-house, Buckhurst-hill.

* Mildred (Mrs). Chigwell.

Dec. 18, 1880. Miller, James, Woodford Walls.

Feb. 25, 1882. Morgan, D. J. (*Verderer of Epping Forest*), Blake Hall, Wanstead.

Nov. 27, 1880. Morten, Thomas S., 42, Haverstock-hill, N. W.

May 28, 2881. Munro, Major R. V., White Hall, Chigwell-row.

Apl. 30, 1881. Newling, Benjamin, Percy-lodge, Wanstead.

Sep. 24, 1881. Newman, Frederick G., Belgrave-villa, Woodford.

June 25, 1881. Noble, George R., Woodford-bridge.

* Oldham, Charles, 2, Warwick-villas, Chelmsford-road, Woodford.

Sep. 24, 1881. Oliphant, Frederick, Chelmsford.

Aug. 28, 1880. Ormerod (Miss), Eleanor A., F.M.S., M.E.S., Dunster-lodge, Spring-grove, Isleworth.

* Owen, John, 320, Old-street, E.C.

* Oxley, Frederick, F.R.M.S., &c., Woodford, *and* 8, Crosby-square, E.C.

Nov. 27, 1880. Parker, Charles J., Rosslyn-villa, Snaresbrook.

* Parker, James F., 6, Adelaide-terrace, Ilford.

Nov. 26, 1881. Pearce, Charles T., M.D., M.R.C.S., Prince's-road Buckhurst-hill.

Nov. 27, 1880. Peile, Rev. Thomas W., Rectory, Buckhurst-hill.

Mar. 26, 1881. Perry (Mrs.), Ferndale, Buckhurst-hill.

Mar. 26, 1881. Perry, George, Ferndale, Buckhurst-hill.

Mar. 25, 1882. Powell (Miss), Emma Sophia, Buckhurst-hill.

* Powell, Nathaniel, J.P., D.L., Buckhurst-hill.

Feb. 26, 1881. Pratt, Benjamin, Snake's-lane, Woodford.

Aug. 28, 1880. Priest, Arthur, M.D., Waltham Abbey.

July 24, 1880. Prince, Charles E., M.R.C.S., Buckhurst-hill.

*†Ramsden, Hildebrand, M.A., F.L.S., F.R.M.S., 26, Upper Bedford-place, Russell-square, W.C.

* Rayleigh, The Right Hon. Lord, M.A., F.R.S., &c. (*Professor of Experimental Physics, University of Cambridge*), Vice-President, Terling-place, Witham, *and* 5, Salisbury-villas, Cambridge.

Oct. 1, 1881. Raynor, Gilbert H., M.A., Hazeleigh Rectory, Maldon.

Aug. 28, 1880. †Reay, The Right Hon. Lord, D.C.L., F.R.G.S., &c. (*President Social Science Congress*), 6, Great Stanhope-street, Mayfair, W.

Sep. 24, 1881. Rees, George, "Oakhurst," Chigwell.

July 24, 1880. Reeves, Luther, Prospect-cottage, George-lane, Woodford.

June 25, 1881. Reid, George T., Tuiling-cottages, Beulah-road, Walthamstow.

Feb. 25, 1881. Reid, J. L., St. Kilda-villas, Buckhurst-hill.

Nov. 27, 1880. Richardson, Edwin, 289A, King's-road, Chelsea, S.W.

Oct. 29, 1881. Ridley (Miss), Marian, 7, Cambridge-square, W.C., *and* Hollington-house, Newbury, Hants.

* Robarts, N. F., F.G.S., Vice-President, Rosebrae, Glengall-road, Woodford.

* Robarts, Sydney, Stamford-hill, N.

* Rodwell, Rev. R. M., M.A., Rectory, High Laver.

June 25, 1881. Ross, W. J. Clunies, B.Sc. (*Lond.*), F.G.S., &c., 4, Trinity-terrace, Bow, E.

Aug. 28, 1880. Rosslyn, The Right Hon. the Earl of, M.A., F.Z.S., Easton-lodge, Dunmow.

* Russell, Rev. A. F., M.A., Rectory, Chingford.

Jan. 22, 1881. Russell, Lieut.-Col., J.P., D.L., Stubbers, Romford.

* Saul, David H., Dover-house, Fairlop-road, Leytonstone.

* Saward, William, Epping.

Oct. 29, 1881. †Selwin-Ibbetson, Sir H. J., Bart., M.A., M.P., J.P., D.L., &c., Down Hall, Harlow, *and* 16, James-street, Buckingham-gate, W.

Nov. 26, 1881. Shenstone, J. C., F.R.M.S., Colchester.

* Shipley, Arthur E., Springfield, Windsor, Berks.

Mar. 25, 1882. Shrewsbury, A. W., Forest-house, Woodford.

June 25, 1881. †Smith, Griffiths, F.R.G.S., Widdington, Newport, Essex.

May 29, 1880. Smith (Mrs.), Mary, Woolpits, Great Saling.

Jan. 22, 1881. Smith, Samuel, 331, Hackney-road, N.E.

* Smith, Sidney, Tavistock-villa, Lea-bridge-road, Leyton.

* Smith, W. G. S. (*Hon. Sec.* "*Forest Fund*"), Rose-cottage, Forest Gate.

* Smither, William, Woodford Wells.

* Smoothy, Charles, Bexfields Farm, Galleywood, Chelmsford.

Jan. 22, 1881.* Snell, Edward A., M.B., &c., 70, City-road, E.C.
* Spicer, Albert, Woodford.
Nov. 27, 1880. Spicer (Miss) Ellen, "Harts," Woodford.
* Spicer, George, "Dunraven," The Ridgeway, Enfield, Middlesex.
Aug. 13, 1881. Spicer, Henry, B.A., F.L.S., F.G.S., 14, Aberdeen-park, Highbury, N.
* Spiller, John, F.C.S., 2, St. Mary's-road, Canonbury, N.
* Spiller, William, F.C.S., Fitzjohn's-avenue, Hampstead, N.W.
Mar. 26, 1881. Spring, Henry, Woodford Wells.
* Stable, Robert S., Cleveland-road, Wanstead.
* Stainton, H. T., F.R.S., F.L.S., F.G.S. (*President of the Entomological Society*), Mountsfield, Lewisham, S.E.
Oct. 1, 1881. Stead, W. H., Hexham-house, York-road, Birkdale, Southport, Lancashire.
June 25, 1881. Stear, Henry, M.R.C.S., Saffron Walden.
* Stephens, R. Darell S., F.L.S., F.G.S., F.Z.S., Bradpole, Bridport, Dorset.
* Stevens, William, The Green, Woodford.
Jan. 22, 1881. Stewart, Frederick.
June 25, 1881. Stringer, Edwin T., Princes-road, Buckhurst-hill.
* Swallow, Rev. R. D., M.A., Grammar-school, Chigwell.
* Sworder, Charles B., Woodlands, Epping.
* Sworder, Walter, 1, Blandford-villas, Queen's-road, Buckhurst-hill.
May 28, 1881. Tabrum, Burnett, Margaretting-lodge, Leytonstone.
* Taylor, Thomas P., M.R.C.S., L.A.C., F.R.M.S., Essex and Colchester Hospital, Colchester.
May 29, 1880. †Thomas, Charles, F.G.S., F.R.M.S., Clarendon-house, Buckhurst-hill.
Jan. 22, 1881. Thomasin, James G., St. Ann's, Hendon, Middlesex.
Jan. 22, 1881. Thomasin (Mrs.), J. G., St. Ann's Hendon, Middlesex.
* Thompson, A., 60, East India-road, Poplar, E.
June 26, 1880. Thompson, Ernest E., 66, Albany-street, Regent's-park, W.
July 24, 1880. Thompson, Robert M. Bird, Walden-hall, Saffron Walden.
Nov. 27, 1880. Thorp, William, B.Sc., F.C.S., F.I.C., 39, Sandringham-road, Kingsland, E.
May 28, 1881. Till, John Smyth, "The Laurels," Palmerston-road, Buckhurst-hill.
Feb. 26, 1881. Tozer, Augustus H., White Hall-lane, Buckhurst-hill.
* Tozer, Edward, Woodford.
June 26, 1880. Travis, J., Saffron Walden.
* Trimmer, Francis, M.D., Forest Gate.

Aug. 28, 1880. Turner, W. Pickett, M.R.C.S., Lancaster-terrace, Leytonstone.

* Tweed, Walter, Epping.

Oct. 29, 1881. Unwin, Edward, "Rosedale," Hendon-road, Lee, Kent.

June 25, 1881. Unwin, George, Chilworth, Surrey.

* Unwin, T. Fisher, 19, Southampton-street, Bloomsbury-square, W.C.

Dec. 17, 1881. Varenne, E. G., M.R.C.S., Kelvedon.

Nov. 27, 1880. Varley, Frederick H., F.R.A.S., M.P.S., Mildmay-avenue, Highbury, N.

* Vaughan, Howard, M.E.S., 11, Ospringe-road, Brecknock-road, N.W.

* Vincent, Ralph, Leytonstone.

* Wakefield, W. T., Farm-hill, Waltham Abbey.

June 26, 1880. Walker, Rev. F. A., B.D., F.L.S., Elm-hall, Wanstead.

June 25, 1881. Wall, Philip W., M. Inst. C.E., F.G.S., Clevedon, Somersetshire.

June 26, 1880. Waller, John, 5, Talbot-road, Tottenham, N.

Aug. 28, 1880. †Walsingham, Lord, M.A., F.Z.S., M.E.S., Eaton-house, Eaton-square, S.W.

May 28, 1881. Warburg (Mrs.), 11, Upper Bedford-place, Russell-square, W.C.

Sep. 24, 1881. Warburg, Simeon, 52, Doughty-street, Mecklenburgh-square, W.C.

Aug. 13, 1881. Warburg (Mrs.), S., 52, Doughty-street, Mecklenburgh-square, W.C.

Sep. 24, 1881. Warner, Compton, "The Rookery," George-lane, Woodford.

May 28, 1881. Weller, George, M.R.C.S., The Mall, Wanstead.

Nov. 27, 1880. Wells, Frank B., 25, Lorne-road, Finsbury-park, N.

June 25, 1881. Westhorp, T., Loughton.

Nov. 27, 1880. Wheeler, E., Whitehall-road, Woodford.

* Whitbourn (Miss), Darwen-house, Buckhurst-hill.

* White, William, Morden-house, 55, Highbury-hill, N.

Mar. 25, 1882. Wilkinson, Henry M., 25, Blandford-square, Marylebone, N.W.

Nov. 26, 1881. Williams, C. Greville, F.R.S., F.C.S., 6, St. Stephen's-villas, St. Stephen's-road, Hounslow.

Apl. 30, 1881. Williams, M. Whiteley, F.C.S., F.I.C.. 18, Kempsford-gardens, S.W.

* Wilson, Rev. W. Linton, M.A., Vice-President, "Oakhurst," Chigwell.

*† Winstone, Benjamin, M.R.C.S., Ockeridge, Epping; *and* 53, Russell-square, W.C.

June 25, 1881. Winter (Mrs.), Lewis, "Clements," Snaresbrook.

Feb. 25, 1882. Wire, Alfred P., 13, Mornington-terrace, Leytonstone.

June 25, 1881. Wright, Rev. A. B. Bingham, M.A., Stebbing Vicarage, Chelmsford.

June 26, 1880. Wright, W. H., Oakburn, New-road, Buckhurst-hill.

Jan. 22, 1880. Wright, Rev. W. J., B.A.

* Yeates (Mrs.), Erin-villa, Buckhurst-hill.

Mar. 26, 1881. Yorston, A. J., "The Hollies," Palmerston-road, Buckhurst-hill.

* Young, Frederick, J.P., &c. (*President "Forest Fund"*), 5, Queensberry-place, Queen's-gate, S.W.

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TRANSACTIONS

OF THE

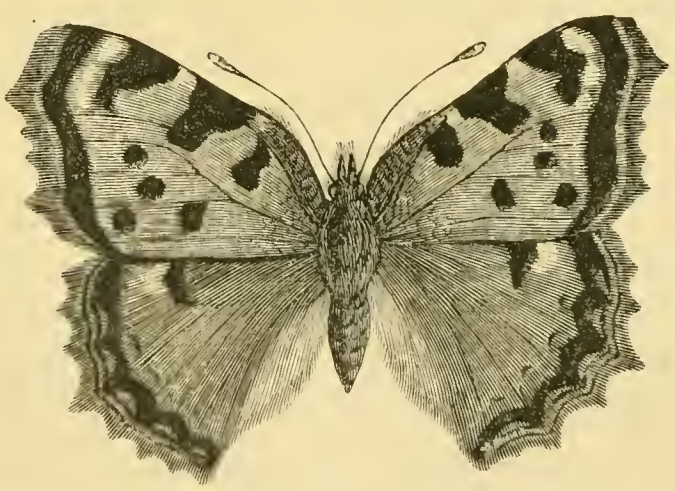
EPPING FOREST AND COUNTY OF ESSEX NATURALISTS' FIELD CLUB.

I.—Is *Vanessa Polychloros* the prototype of *V. Urticæ?* A Query suggested by the Aberrant Form of a specimen of *V. Urticæ* of *Polychloros* type.

By William White.

[Read February 26th, 1881.]

The caterpillar of the *Vanessa* exhibited was taken at Highgate-Hill in 1879, included in the larval "web" of a community of *Urticæ*, and was reared throughout its existence with the rest of the brood entirely upon nettle (*Urtica*). During the larval stage there was nothing notice-



able in its appearance to distinguish it in any way from its companions. In the chrysalis form it bore the specific characters of *Urticæ* as regards its angular projections and general contour, but the colours were somewhat richer in

tone than is usual, sufficiently so to attract special notice. The imago is rather below the average measure of *Polychloros* in expanse of wings, being about the usual size of *Urticæ* (two inches). The insect is the only individual of the brood known to have varied, even in the slightest degree. Although I did not see every member of the brood, I can vouch for at least forty or fifty specimens, which I examined carefully, and found not a trace of variation in any single case. No larvæ of any other species of *Vanessidæ* were reared contemporaneously with the brood.

I have examined the antennæ of this specimen under the microscope, and find that they present the special characters found in *Polychloros*.

From these facts I make four deductions, all of which turn upon points of interest. It is from such instances of divergence as the present that we are enabled to gain some clue respecting the affinity of species known to be closely related, and for this reason I offer the following observations :—

1. As *Polychloros* lives upon elm and other trees, and *Urticæ* upon nettle and low plants, the instance is valuable as affording further evidence of the fact that neither a particular food nor a change in diet affects in any way the colouring and markings of the perfect insect, so as to offer *per se* a means of originating "varieties." This conclusion is valid whether the specimen under consideration be really a *Polychloros* or *Urticæ*. Many experiments upon different species of insects agree, I believe without exception, in so deciding this question.

2. On the supposition that the specimen is the product of *Polychloros* parents, it is easy to infer either that the ovum was dropped whilst the female was on the wing, or else that the young caterpillar fell from a neighbouring tree soon after emergence from the egg ; in either case the accident must have occurred immediately over the *Urticæ* web. As the broods of the two species rarely appear synchronously, the conjecture is scarcely to be entertained, even if the accident were probable. On such a supposition, however, it is to be deduced that (if *Polychloros*) the society of an allied species

does not affect the development of the individual, but such individuals are treated as friends. It is to be remembered, at the same time, that the larva of *Urticæ* bears a much closer resemblance to *Pyrameis Cardui* than to *Polychloros* [specimens of larvæ (preserved) were exhibited for the sake of comparison.]

3. If it happen to be a hybrid[1] between the two species, it offers an instance of the fact which has been proved by Darwin and others, that in the case of hybrids between closely-allied forms the progeny, instead of assuming direct intermediate characters, inherits the characters of one or other of its parents; and that in numerical proportions varying with the circumstances. As my specimen is the only known individual of the swarm the theory is rather a lame one.

4. Lastly, on the understanding that the specimen is the development of an *Urticæ* larva, we must conclude that it is *a case of recurrence to a previous form, and, if so, that form was Polychloros;* that, while *Polychloros* has not changed, the change of habitat and environment has brought about the marked variety which now constitutes a separate species in *Urticæ.* In favour of this supposition I may instance the well-known fact that *V. Urticæ*,[2] like *V. C-Album* and *P. Cardui*, varies occasionally in colour, markings, and size, whilst *Polychloros* is much more persistent—indeed almost invariable—in type, though irregular in point of size. The latter variability, however, is common to all classes of animals at any given period.

This persistency of type argues an antiquity beyond that of its allies, and makes it appear highly probable that *V. Polychloros* is the ancestral prototype of *V. Urticæ.*

[In connection with Mr. White's paper, it may be interesting to quote the following record of a similar experience

[1] [The Rev. G. H. Raynor records ('Entomologist' vi. 221), finding a specimen of *V. Urticæ in coitu* with *V. Polychloros*.—Ed.]

[2] Newman, in his 'British Butterflies,' gives woodcuts of four aberrations of *Urticæ*, but not one of *Polychloros;* nor does he instance any variation in the latter species.

given in the 'Entomologist' vi. 88:—"In the spring of last year I took the larvæ of what I considered to be *V. Urticæ* feeding on nettles, and from time to time added other larvæ of *Urticæ* in the same breeding-cage kept for nettle-feeders only; to my surprise a number of the imagos resembled *Polychloros* in colour and markings, keeping the size of *Urticæ*. I submit them to you for your your remarks. There was no apparent difference in the larvæ that I observed while feeding. —James A. Tawell, Earl's Colne, March 11th, 1872." The late Mr. Newman headed this note "*Polychloros* Larvæ feeding on Nettle," and described the butterflies as follows:—"These specimens have a wonderful similarity to *Urticæ*, which they do not at all exceed in size; still the colour is nearer to that of *Polychloros* than that of *Urticæ;* and the black spot at the anal angle of the fore wing is present, as in *Polychloros;* the white spot on the costa of *Urticæ* is absent, also as in *Polychloros*." Some of these specimens were presented to Mr. Newman, and, as we are informed by Mr. B. T. Lowne, are now in the collection of the Entomological Club.—Ed.]

Discussion.

The President stated that Mr. White's query was, in his opinion, very suggestive, but he was disposed to think that it was hardly based upon a sufficiently broad view of the true state of affairs with respect to the genus under consideration.

The facts are that our native "Tortoiseshells" are representatives of a genus comprising about two dozen or more species ranging throughout Europe, Asia, and North and South America; or, in other words, throughout the greater portion of the Palæarctic, Nearctic, Neotropical, and Oriental zoological regions. Now *V. Polychloros* and *V. Urticæ* are two of a group of species more or less resembling them in colour and marking, this group being linked by a large number of intermediate forms with our *C-album* or "Comma" butterfly. He had thought the matter of sufficient interest to draw up the following list of species, showing the transition in question:—

V. C-album ..... Europe, N. and W. Asia.
V. I-album ..... Asia Minor, S. Europe.
V. V-album ..... Asia Minor, S. Europe.
V. Californica ..... California.
V. Polychloros ..... Europe, Asia.
V. Xanthomelas ..... E. Europe, N. India.
V. Cashmirensis ..... N. India.
V. Urticæ ..... Europe, W. Asia.
V. Milberti ..... S. America.

These were only a few of the more striking transitional forms selected for the purpose of illustrating the argument.

In the language of evolution we should therefore say that the genus *Vanessa* was in a very complete state of phyletic preservation, *i. e.*, all the species having diverged from a common ancestor, the various steps in the process of divergence, instead of having become extinct and leaving large gaps between the species, as so frequently happens, have been more or less preserved down to the present time. *Polychloros*, *Xanthomelas*, *Urticæ*, &c., are thus true blood-relations, and, in accordance with the laws of heredity, it is not therefore surprising, although extremely interesting, that we should find one of these species occasionally giving rise to a variety resembling an allied form. If, therefore, Mr. White means to ask whether *Polychloros* is the progenitor of *Urticæ* on the strength of his having obtained a variety of the latter resembling the former, he (the President) would be inclined to answer that the two species under consideration, with their congeneric forms, had all descended from a common ancestor, and that the variety in question was a case of reversion to this ancestral type.

In illustration of the foregoing remarks the President exhibited specimens of *Urticæ* and *Polychloros*, with the intermediate North Indian *V. Cashmirensis*, and, as a parallel case, *Pyrameis Atalanta* and *Cardui*, with the intermediate *P. Callirhoë*, likewise from N. India.

[Mr. A. G. Butler, F.L.S., F.Z.S., of the Zoological Department, British Museum, has kindly furnished the Editor with the following valuable observations on the above:—

"I have read Mr. White's paper carefully through, and I must say that I perfectly agree with Mr. Meldola.

"The fact that the larva of *V. Polychloros* feeds upon elm, whereas that of *V. Urticæ* feeds upon nettle, would naturally lead me to look for a mutual progenitor of these and the numerous allied species whose larvæ should feed indiscriminately upon either the tree or the weed; this we find in *V. C-album;* therefore it is more probable that the group to which the latter species belongs is the parent of both *V. Polychloros* and *V. Urticæ* than that the latter should be derived from the former.

"The different races, or perhaps seasonal forms, of *V. C-album* show considerable modifications in the outline of the wing; and an examination of foreign species shows that these modifications may readily become permanent.

"I do not admit Mr. White's statement that food does not produce variation. I have very little doubt, if he will try the same experiment that I have done, his conviction will be seriously shaken. Some years since my friend, Mr. Herbert Goss, reared a number of singularly dark varieties of *Odonestis potatoria*, and the only explanation for this burst of melanism which he could suggest was, that he had been reckless as to the species of grass upon which he fed the larvæ. He subsequently sent me some larvæ, which I fed upon different grass every day, with the result that I did not rear a single typical example, all being melanic and much dwarfed. When I gave up collecting our British moths some years since I got rid of my specimens with the exception of a single pair, which are now in the general collection at the British Museum.

"Mr. White says that his *V. Urticæ* is of the usual size, but with the characters of *Polychloros;* this description would answer very well for *V. Californica*, and, considering the great general resemblance between all the species of the group, the case is not a very remarkable instance of reversion.

"In a brood of about fifty *V. Urticæ*, reared by me, there was a single very dark and small specimen which, although not like *V. Polychloros*, may have been a case of reversion to

something more nearly allied to *V. C-album*; and some of the species allied to the latter are very dark indeed.

"Lastly, as about half the species in the genus have the wings far more deeply dentated and subcaudate than the other half, whilst many gradations between the extremes of these two types exist, it seems most natural to look for the progenitor in a species which exhibits variation of form in accordance with the season, so that one may account for the prevalence of one type in one climate and of the other in another; and to regard two species of the same type as descended one from the other, especially when these two co-exist throughout Europe (or nearly so), seems to me to be a supposition in the highest degree improbable."]

II. The Evolution of Fruits.

By Professor G. S. Boulger, F.L.S., F.G.S.

[Abstract of Discourse delivered *vivâ voce*, February 26th, 1881.]

Syllabus.—The Descent Theory.—Definition of the word "Fruit."—Origin of fruits.—Marginal placentation.—Object of fruits.—Possible cause of the variability of the fruit.—Generalizations as to the course of variation in fruits.—Ontogeny of the fruit.—The phylogenetic importance of the fruit, and the results of the study of the fruit on the phylogenetic classification of flowering plants.

One of the strongest confirmations of the Descent Theory is its vital energy. It is not only consistent with hosts of ever-accumulating facts in every department of Biology, but it is constantly suggesting new lines of inquiry to which it forms the only key. Thus, though in tracing the evolution of the numerous kinds of fruit from the simplest and presumably earliest forms, it is necessary to assume this theory as a working hypothesis, not the least important result of the investigation will be the accumulation of much evidence that by its self-consistence tends strongly to show that the hypothesis truly represents the facts of Nature.

Affixing the definite meaning to the word "fruit" of "the whole of the *gynæcium* which ripens in consequence of fertilisation, together with all surrounding accrescent or succulent parts, originating from a single flower,"—a definition free from many of the objections which attach to Sachs' use of the word for each apocarpous carpel,—we find nothing really analogous to a fruit among cryptogamic plants. The highest degree to which secondary sexual organs are developed in these groups only amounts to the formation of a seed. It is among the Gymnosperms that we have the nearest approach to the origin of the fruit.

Without concerning ourselves with the cognate but distinct

inquiry as to the morphological nature of ovules, we may perhaps safely assert that they are originally, normally, and almost universally developed from the margin of carpellary leaves. In *Cycas* such an origin is obvious, for we have a but slightly modified leaf, some lobes of which only are transformed into ovules. In the Juniper the three scales at the base of which the ovules are situated, becoming succulent, simulate the berry amongst true fruits. In abnormal Primroses the ovules are seen to spring from heel-like, auricular appendages at the base of the carpellary leaves, and all the evidence points to the origin of this order from a Caryophyllaceous ancestry, from which it differs only in having its petals united. The originally marginal character of the placentation of the *Caryophyllaceæ* is clearly seen, *e.g.*, in the carnations (*Dianthus*). The structure of those groups in which the placentation is still simpler, such as the *Polygonaceæ*, in which there is a single ovule rising from the base of the one-chambered ovary, may be best explained as reduction from the same marginal type.

The original fruit consisting then of a single carpellary leaf or of several, the ovules in either case being marginal structures, before tracing the general rules followed by Nature in the variations of fruits, it is necessary to consider the objects which fruits have to accomplish. The ultimate object of the fruit is subsidiary to that of the seed—the reproduction of the species. The immature seed requires protection from decay-producing excess of moisture or from the depredations of birds. The mature seed requires a non-conducting covering, that it may not be stimulated into premature germination by the deceptive warmth and moisture of autumn. Many plants producing offsets and many seeds necessarily falling near the parent plant, the species becomes a social one, like the grasses of our temperate regions, in which case the struggle for existence is more than usually severe, the relations of each individual to its surroundings—its hexicology—being similar to those of its neighbours, and in no way complementary to them. Accordingly dispersion is advantageous, especially to trees, beneath the shade of

which seedlings can hardly flourish. It is to secure the dispersion of the seed that fruits become attractive to birds.

In the insertion of foliar organs the spiral arrangement is far more general and in all probability earlier than the whorled: the multiplication of similar parts is a rudimentary character throughout organic nature, as exemplified in the somites of a centipede or the tail-vertebræ of *Archæopteryx*; every probability of comparative anatomy points to the earliest carpels as being as leaf-like as those of a pea, or of the bladder-senna (*Colutea*), and to the ovules as being several in number in each of the distinct carpellary ovarian chambers. In other words, we have as our primitive fruit a spiral of follicles, as in *Magnolia*.

That from such a starting-point such infinitely various forms should have resulted may perhaps be partly explained by the abundant supply of available nutriment determined towards the ovary by the act of impregnation, as towards a leaf or shoot by the virus of a gall-fly.

Reproductive structures being produced under influences diametrically opposed to those stimulating vegetative growth, there is a general tendency to truncation of the floral axis, the alternate phyllotaxis thus producing an arrangement of the floral organs in whorls of five or three—an arrangement soon inherited congenitally.

The crowding of the organs towards the centre of a flattened floral receptacle tends to reduce the number of carpels compared to that of the sepals, petals, and stamens; and similarly the crowding within the ovary tends to produce the abortion and reduction in the number of ovules. Nor is this mechanical result disadvantageous. It allows of the larger growth of the seed, *i. e.*, the accumulation of a more abundant food-supply, rendering the seedling longer independent of the atmosphere. Most small annuals, which are exposed to great risk of individual extermination, produce numerous small seeds; but, as large and highly-organised animals, such as the elephant, produce few offspring, so trees which exist longer individually do not require many seeds in

order to perpetuate their species. Thus we see such reduction both in the palms and in the oak.

As an elongated floral receptacle represents a lower type of structure than one horizontally expanded, and this again is earlier than the arrangement by which the ovary appears to be sunk in the receptacle, owing to an absence of separation for some distance between the axial and lateral structures, hypogynous insertion, as it is technically termed, probably preceded perigynous, and perigynous preceded epigynous.

The comparative anatomy of a group tells us far more as to the structure and evolution of fruits than we can learn from ontogeny, or the study of individual development. All foliar organs originate alike as a mere succulent, cellular papilla; and in vegetable ontogeny stages are so readily masked that whorled carpels seldom show any trace of primitively spiral arrangement, nor can we learn much from their early stages as to the true nature of ovules. Ontogeny is perhaps most useful in discriminating the origin of those layers of the pericarp which are known by the ambiguous terms, epicarp, mesocarp, and endocarp. Probably the carpels of the primitive fruit would so far retain their foliar character as to wither into a dry, parchment-like consistence, and burst by the consequent contraction. Cellular structures in this state are generally slightly hygroscopic, so that we have here the origin of many cases of violent dehiscence facilitating the dispersal of seed.

If, bearing in mind these general principles, we glance at the distribution of the different varieties of fruits through the natural orders, we are at once struck by the fact that the fruit-type is a character of high phylogenetic importance. The caryopsis of the grasses, the silicle of crucifers, the hesperidium of the orange tribe, the drupe and the pome in two sections of the *Rosaceæ*, the legume of the *Leguminosæ*, the cremocarp of the *Umbelliferæ*, the pepo of the gourd tribe, the cypsele of the *Compositæ*, and the nut of the *Cupuliferæ*, are familiar instances of this. It occurred to me, therefore, to review the natural orders from this stand-point, not disregarding other characters, but paying particular attention

to the fruit as a guide to their affinities. It is impossible here to do more than indicate my results, which have far exceeded my original hopes.

A very slight knowledge of plants convinces one of the great natural importance of the distinction, first pointed out by the botanical glory of Essex, John Ray, between Monocotyledons and Dicotyledons. Adopting this primary division, and considering Mr. Bentham's *Nudifloræ* as the lowest among Monocotyledons, we find that we have many monocarpellary fruits in very rudimentary flower-types, followed by a ring of apocarpous follicles, generally six in number, in the flowering-rush (*Butomus*), and by a spiral of more numerous ones in the water-plantain (*Alisma*); but that syncarpy is early originated (even in the *Lemnaceæ*), the fruit becoming capsular, and that succulence also originates early (in the *Araceæ*). We constantly find in tracing the evolution of fruits that Nature arrives at the same result, such as the capsule or nuculane, by various routes; hence the practical uselessness of an artificial grouping of fruits.

Among Mr. Bentham's *Coronarieæ* a syncarpous fruit of three carpels asserts itself as the typical monocotyledonous fruit; succulence re-appears, as in *Asparagus* and *Ruscus;* and we get the previously-mentioned reduction in the cocoa-nut and date, accompanied in the former with that development of woody texture in the pericarp, which proves an effectual protection against the action of sea-water, if not against crabs or monkeys.

The *Glumifloræ* I consider merely as reduced from the last-mentioned type, their one-seeded caryopsis illustrating a general principle which should have been before stated, that when numerous small flowers form a crowded inflorescence (as also in *Compositæ* and *Umbelliferæ*) we have a reduction in the number of carpels answering to a reduced need of them.

Among Dicotyledons my examination led me to recognise four great groups, for which I select the names *Thalamifloræ*, *Discifloræ*, *Perygynæ*, and *Bicarpellatæ*. Of these the second seems undoubtedly a branch-phylum from the first, and the fourth probably from the third. Among the *Thalamifloræ*

the various apocarpous fruits, first spiral and then whorled, of the Ranales, of which the Laurales are probably reduced types, lead through the fruits of the water-lilies (*Nymphæa*) and of *Sarracenia* to that of the poppy (*Papaver*); and in the same tribe we have reversion to apocarpy in *Platystemon* and a transition to the siliqua in *Glaucium* and *Chelidonium*. Among *Cruciferæ* the genus *Tetrapoma* (an illustration of the fact, well known to biologists, that exceptional forms teach us more than those which are regular or typical) indicates the close affinity to the other *Parietales*, the capsules of *Resedaceæ*, *Violaceæ*, &c.; and we have here probably a great "centre of divergence" leading to the *Discifloræ*, *Guttiferales*, *Malvales*, and *Centrospermæ*. Of the latter mention has been made already; among the *Malvales* I can only now refer to the succulent *Malvaviscus* and the sand-box tree (*Hura crepitans*) which indicates that relationship between the *Malvaceæ* and *Euphorbiaceæ* which is paralleled by that between *Tiliaceæ* and *Urticaceæ*; among the *Guttiferales* the capsule with central placentation leads from *Camelliaceæ* to *Ericaceæ*; and among *Discifloræ* the superior schizocarp with a central gynophore in *Geranium* leads to the fruit of *Tropæolum* and the stipitate capsule in the *Rutaceæ*, which, being sometimes fleshy, passes to the "hesperidia" of the orange tribe, whilst the Celastrales, with the varying "nuculanes" of the holly, *Euonymus*, Buckthorn, and Vine, lead to the still more variable fruits of the Sapindales, which range from the horse-chestnut and Litchi to the winged "samara" of maple and sycamore.

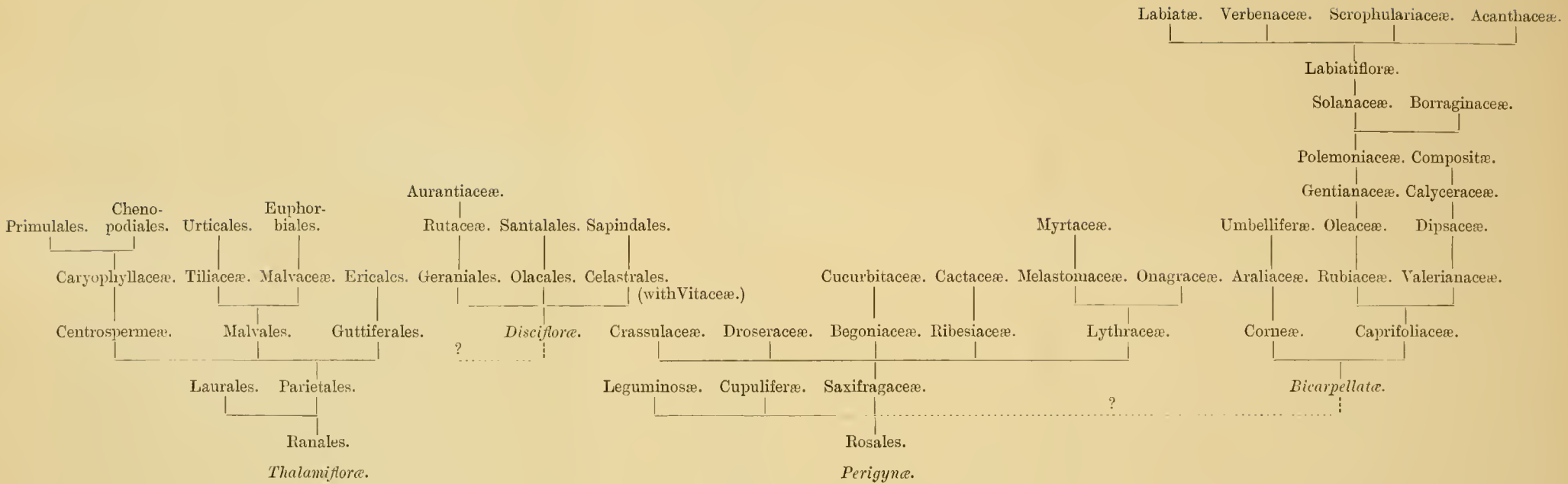
The *Perigynæ*, commencing with the numerous related fruit-types of *Rosaceæ*, among which the "etærio" of achenes in *Potentilla* perhaps represents the primitive type, lead through the *Drupaceæ* to the legume, perhaps through *Pomeæ* to the nut of the *Cupuliferæ*, and through *Spiræa* to the Saxifrages. Here we get a semi-inferior fruit with the carpels reduced in number, near which the branch-phylum of the *Bicarpellatæ* (well represented by the Umbellales) may have been given off; whilst it has certainly been a centre of divergence leading through *Hillebrandia* to the *Begoniaceæ*

and the gourds, through the berries of *Ribes* to the *Cacti* and through *Lythraceæ* to *Melastomaceæ* and *Myrtaceæ*, which latter order includes the pomegranate and the Brazil-nut.

The *Bicarpellatæ* only have more than two carpels in the case of the three primitive orders, *Cornaceæ*, *Araliaceæ*, and *Caprifoliaceæ;* but in these cases the fruit is as essentially a cremocarp as in the *Umbelliferæ*. This is reduced in the *Valerianaceæ* to the cypsele of the *Dipsaceæ*, *Calyceraceæ*, and *Compositæ*, which, though one-chambered and one-seeded, is essentially bi-carpellate, as is also the olive, the fruits of the *Gentianaceæ*, the "carcerule" of the *Borraginaceæ*, and *Labiatæ;* and the varying capsules and "nuculanes" of *Scrophulariaceæ* and *Solanaceæ*.

These affinities are shown by the tentative pedigrees, which are shown in the accompanying table.

PHYLOGENY OF DICOTYLEDONS.



III. The Blackwater Valley, Essex.

By W. H. Dalton, F.G.S., of H.M. Geological Survey.

[Read March 26th, 1881.]

Plate I.

The lower part of the valley of the Blackwater offers some marked peculiarities of geological, and therefore geographical, structure, and it has occurred to me that a sketch of it might form a useful illustration of some general principles of those sciences.

From the range of the Chalk hills overlooking Royston the surface of the country slopes gently to the south-east as far as Witham and Chelmsford, and then rises in the bold ridge of Tiptree Heath and Danbury, separated by the estuary of the Blackwater.

Part of this area is drained northward by the Cam, which has cut its way back through the escarpment of the Chalk at Saffron Walden; the western part is drained by the Lea, and the north-east by the Stour and the Colne, whilst the central part, extending from Dunmow to Coggeshall, may be termed the Blackwater Basin, though the rivers traversing it bear the names of Cann, Chelmer, Ter, and Guith, the easternmost stream only being termed Blackwater. The course of all these is, roughly speaking, south-eastward, down the general slope, into which they cut more or less deeply. On reaching the ridge mentioned above, they flow along its foot from either end, successively combining with each other, and passing into the estuary near the middle. I need not enter into the subordinate deviations of these rivers from their general course, but may remark, in passing, that the upper part of the Blackwater proper, called the Pant, is in the direct line of the Guith from Shalford to Bocking, and then passes by a more easterly course to Coggeshall and Kelvedon.

The broad gentle slope traversed by these rivers consists of Boulder Clay, at the surface, from ten to eighty feet thick, underlaid by sand and gravel, rarely more than thirty feet thick, and sometimes altogether absent, and this by the London Clay, the limits of which are near a line through Thaxted and Bishop Stortford. To the north-west of this line is a narrow belt of the Lower London Tertiaries, followed by the Chalk, the Boulder Clay and subjacent gravels generally concealing these older beds. On the flanks of the Ter Valley occur patches of clean brick-earth overlying the Boulder Clay, but possibly constituting only the upper part of that formation, and not separated from the remainder by any important interval.

Between Witham and Feering the Boulder Clay, which previously only formed the plateau between the Guith and Blackwater, descends suddenly into the valley, not only cutting off the gravels that originally lay below it, but passing below the general surface of the London Clay, as shown in the valley bottoms at Coggeshall, Faulkbourn, &c. The Boulder Clay only rises a short distance up the flank of the Tiptree ridge, the sides and crest of which are coated with a considerable depth of sand and gravel.

A part of Tiptree Heath having been fixed upon as a good site for the second County Asylum, an artesian well was resolved upon as the only satisfactory source of water supply. Calculation from the nearest of previous wells showed that there was some local disturbance. The Chalk surface descends from Braintree to Witham at the rate of 21·23 feet per mile, giving depth at Asylum of 495 feet, whilst it rises from Maldon and Heybridge at 74 feet per mile, giving depth at Asylum of 194 feet.

Three possibilities presented themselves :—

1. There might be a gentle roll over of the beds.
2. There might be a powerful undulation or reversal of the beds.
3. There might be a fault throwing down the beds to the north.

The boring proved the last two of these contingencies to be combined.

The base of the London Clay was met with at 295 feet, in the shaft, with a westerly dip of 18 in 68. Boring soon afterward commenced in the Reading Beds, and at 343 feet a fault was passed, and the *London Clay reappeared*. Its base was again reached at 383, the Thanet Sands at 422, and the Chalk at 477 feet. The Reading and Thanet Beds must be inclined at high and varying angles, as at Witham (only two miles off) they are only 27 and 24 feet thick respectively.

We have here, therefore, a great wave, broken along the crest, of the earth's crust, and, in a way that is most unusual, determining approximately the form of the surface. In hard rocks such a structure would most likely be along a valley, with beds dipping into the hill on both sides. Even if a stream had commenced a channel vertically over the present course of the Blackwater, landslips would have perpetually occurred from the south-east bank, till the stream was shifted to the centre of the geological ridge.

But in this case the surface consists chiefly of gravel, without any bedding to produce landslips, and the underlying clay is a homogeneous mass, more prone to slipping along its joint faces than the slightly-marked bedding-planes, so that internal structure does not much affect the physical features.

But the coincidence of a very marked ridge with an exceptional undulation of the beds is suggestive of cause and effect, and the draping of the hill with Glacial gravels, usually only present at lower levels, and the absence from the crest of any trace of Boulder Clay, which mantles round the foot of the ridge to the N.E., seem to point to an elevation *during the Glacial period*, whereby the crest of the ridge was raised above the berg-covered sea, and a current produced at its foot, which scoured away the gravel and dug into the London Clay, leaving a channel to be afterwards occupied by the Boulder Clay.

On the subsequent emergence of the entire country, the slope of the clay-bed determined the general trend of the streams down to the N.W. foot of the ridge, and during the cutting through of the estuary a lake was formed by the

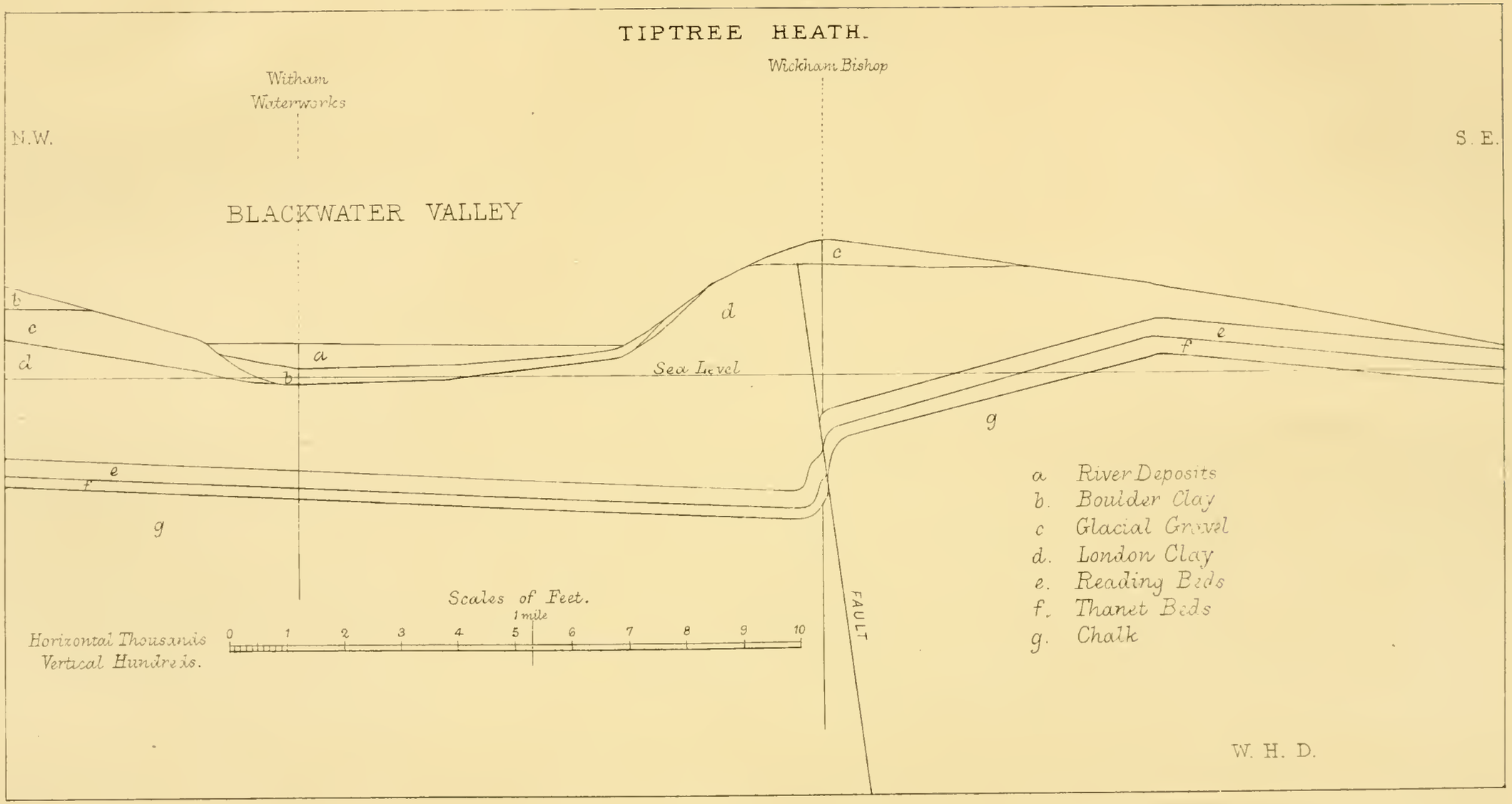
accumulated waters. The gravel brought down into this lake by the Guith and Blackwater forms a continuous terrace from Witham to Braintree, interbedded with shell-marl, swamp-mud, and brick-earth, as described in the Geological Survey Memoir on Sheet 47.[1] The elevation continued till the deep channels of the Essex estuaries were formed, when subsidence took place, readmitting the sea as far as Colchester, Maldon, and Battle Bridge. I have elsewhere published reasons for believing that a slight subsidence is now in progress.[2]

Those who care to investigate the origin of the undulation described above may be interested in hearing that a parallel undulation has been noticed in the Chalk ridge above Royston, with an outward north-westerly dip of 60°, and that the prolongation of the line of Tiptree Heath coincides, near Deptford, with a fault bringing up the Chalk through the Tertiaries, and, in the opposite direction, we have Chalk coming to the surface in an abnormal way, at Shelly (near Hadleigh) and at Ipswich, whilst farther away in Suffolk other points of disturbance have been noticed along a line nearly coincident with the Yarmouth branch of the Great Eastern Railway.

I must defer to another occasion my reasons for supposing that the undulations are confined to the upper 1000 feet of the earth's surface, and are due to lateral pressure in the Chalk, and that the subjacent Coal-Measures or other rocks are not affected thereby.

Whitaker, W., W. H. Penning, W. H. Dalton, and F. J. Bennett. 'The Geology of the N.W. Part of Essex and the N.E. Part of Herts., with Parts of Cambridgeshire and Suffolk.'—*Geological Survey Memoir.* 8vo. London. Pp. vi., 92; 19 woodcuts. Price 3*s.* 6*d.*

[2] 'Subsidence in East Essex.'—*Geol. Mag.*, dec. ii., vol. iii., pp. 491—493. (1876).



Trans. Essex Field Club. Vol. II. Plate I.

West, Newman & Co. Imp.

IV. The Developmental Characters of the Larvæ of the Noctuæ as determining the Position of that Group.

By Raphael Meldola, F.C.S., V.P.E.S., &c.

[Read March 26th, 1881.]

I am induced to bring a few remarks on the above subject under the notice of the Club, because we have among us a large number of Lepidopterists to whom these observations may be of use, from the twofold point of view of suggesting a fruitful line of work for those who are in the habit of larva breeding, and, on the other hand, as having some bearing on the actual cabinet arrangement at present adopted by many of our collectors.

Among the many classes of biological facts that have received an explanation by the publication of Darwin's 'Origin of Species,' the phenomena of embryology, or the development of the individual organism from the germ to a state of maturity, are of the highest importance as revealing in many cases the history and true affinities of groups of species. In the course of its development an animal passes through stages which successively represent, with more or less completeness, the stages through which the species has passed in arriving at its present condition. The development of the individual is in this sense spoken of as the "ontogeny," and the development of the race is known as the "phylogeny." In accordance with the Darwinian theory all the species of one group, such as a genus, have descended from a common ancestor, so that all the species of such a group would be expected to approach each other more closely in their characters at certain stages of their ontogeny than when adult, or, as Haeckel has expressed it, the ontogeny recapitulates the phylogeny with more or less falsification, owing to the necessary abbreviation of the successive stages. By comparing the ontogeny of allied species and groups of

species, we thus arrive at a more certain indication of the true affinities, *i. e.*, the blood relationships, than by comparing adult individuals only.

In order to show the application of these principles, I may perhaps be permitted to give a hypothetical case. Suppose, for example, that the foals of the horse were frequently or invariably striped when young, but lost their stripes as they grew towards maturity. We should be justified on this ground alone in believing, with a great amount of probability, that the horse had descended from a striped ancestor, and if the foals of an allied species, such as the ass, were also striped when young, this probability would be greatly increased. If, on extending our comparisons, we found that other allied species, such as the zebra, were striped throughout their lives, we should conclude, in accordance with the principles of the descent theory, that the horse and ass were derived with the zebra from a common ancestor having the characters of the latter species, and since the horse and ass have, so to speak, outgrown the striped stage of their existence, which, on our supposition, is retained only during a short period of their younger stages of growth, we should say that these species were further advanced in development *i. e.*, were *phyletically younger* than the zebra.

From the above considerations, it will be seen that the ontogenetic development may thus throw much light on the past history of a species or group, and through this on the true systematic affinities. I may now pass on to our immediate subject.

The two systems of classification now made use of by our Lepidopterists are those adopted in Stainton's 'Manual of Butterflies and Moths' (1857), and by Doubleday in his 'Synonymic List' (1866). In the former, the Noctuina are placed between the Bombycina and the Geometrina; in the latter, the Geometræ follow the Nocturni (Sphinges and Bombyces of Linnæus), and are in their turn followed by the Noctuæ, with which they are connected by the Drepanulæ and Pseudo-Bombyces. It is here quite unnecessary to enter into the histories of these two systems of classification.

I propose to deal only with the question as to the affinities of the Geometræ and Noctuæ, since, in the case of these two groups, materials have been accumulating for some years, which, in my opinion, enable us to give a definitive answer to the question of their relative positions.

Before entering into details, I may just call attention to the differences in structure between the caterpillars of the Noctuæ and of the Geometræ.

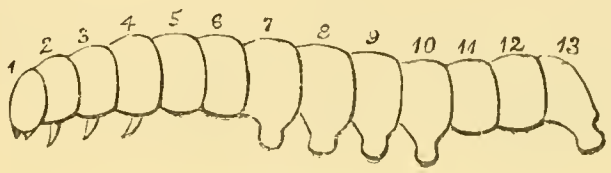


Fig 1

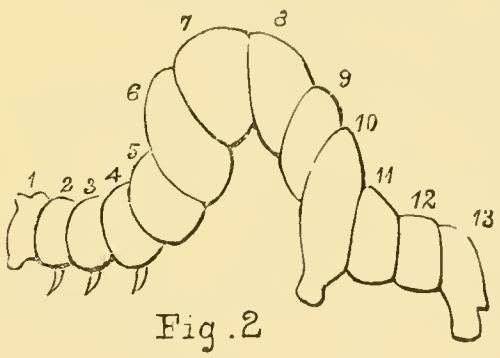


Fig .2

A perfect Lepidopterous caterpillar is composed of thirteen segments, counting the head as the first, and possesses altogether sixteen legs, the three foremost pairs being the true or thoracic legs, which correspond with the legs of the perfect insect. The thoracic legs are horny, and are situated on the 2nd, 3rd, and 4th segments. The other legs, which are fleshy, are known as the abdominal legs, prolegs, or claspers, and are situated on the 7th, 8th, 9th, 10th, and 13th segments. The larvæ of the butterflies, Sphinges and Bombyces, have the full number of legs; the caterpillars of the Geometræ, on the other hand, have, as a rule, only four claspers, one pair on the 10th and 13th segments, so that in walking they arch their backs in the peculiar manner so familiar to us, and which has given rise to the name of "geometer" or "looper." Some few exceptions occur among the Geometræ, such as *Rumia Cratægata* and *Odontopera*

bidentata, which have eight claspers, and *Metrocampa margaritata* and *Ellopia fasciaria*, which have only six; and I would suggest that the ontogenetic development of these species should be studied carefully, with special reference to the number, relative lengths, and positions of the abdominal legs. The Drepanulidæ and Pseudo-Bombyces have in most cases the full number of legs, but the last pair (13th segment) is sometimes absent, or replaced by forked appendages. The majority of the Noctuæ larvæ have sixteen legs, but as we approach the end of the group this number becomes variable, as will be seen from the following list compiled from Stainton's 'Manual':—

TRIFIDÆ.

Bombyciformes.—Larva with 16 legs.

Genuinæ.—Larva with 16 legs.

Minores.—Larva with 10, 14, or 16 legs.

QUADRIFIDÆ.

Variegatæ.—Larva with 12, 14, or 16 legs.

Intrusæ.—Larva with 16 legs.

Limbatæ.—Larva with 16 legs, "but looping the anterior segments when walking."

Serpentinæ.—Larva with 12 or 14 legs.

This fact becomes still more evident, if we make a more detailed analysis of the latter groups:—

MINORES.

Acontiidæ.

Agrophila.—Larva geometriform, with only 12 legs.

Acontia.—Larva geometriform, with only 12 legs. (The larva of *A. luctuosa* is exceptional, having 16 legs).

Erastriidæ.—Larva with 14 legs, half-loopers; 1st pair of claspers indistinct.

Erastria.—Larva with only 3 pairs of claspers.

Bankia.—Larva with 2 pairs of claspers, 3rd pair rudimentary.

Anthophilidæ.—Larva with 12 or 14 legs.

Phalænoidæ.—Larva with 16 legs, but two 1st pair of claspers rudimentary.

VARIEGATÆ.

PLUSIIDÆ.—Larva with 12 or 16 legs, half-loopers.

Abrostola.—Larva with 16 legs, 1st pair of claspers rudimentary.

Plusia.—Larva with 12 legs, other two pairs completely absent.

GONOPTERIDÆ.—Larva with 16 legs.

INTRUSÆ.—See previous list.

LIMBATÆ.—See previous list.

SERPENTINÆ.

OPHIUSIDÆ (Genus *Ophiodes*).—Larva with 16 legs, the two 1st pairs of claspers somewhat shorter than the others.

EUCLIDIIDÆ (Genus *Euclidia*).—Larva with 12 legs.

POAPHILIDÆ.—(*Phytometra Ænea*, larva a semi-looper).

On this evidence alone—supposing for the moment that larval characters were adopted as the basis of our classification—we should be justified in regarding these latter groups of the Noctuæ as most closely allied to the Geometræ, and this conclusion is fully borne out by the perfect insects, since it is among these groups that we find the most Geometriform Noctuæ, such as *Brephos*, *Euclidia*, and *Phytometra*.[1] More than forty years ago Professor Westwood insisted upon the perfectly natural transition from the Noctuæ to the Geometræ, "so beautifully effected by *Catocala*, *Plusia*, and other half-loopers, as their larvæ are termed, and *Ophiusa*, *Erastria*, &c." ('Introduction to the Classification of Insects,' vol. ii., p. 363.)

In order to avoid lengthy repetitions, I will in future speak of the groups *Bombyciformes* and *Genuinæ* as "Bombyciform Noctuæ," and of the *Minores*, *Variegatæ*, *Intrusæ*, *Limbatæ*, and *Serpentinæ* as "Geometriform Noctuæ." It is obvious that the relationship of the latter to the Geometræ is accurately expressed by the arrangement in Stainton's 'Manual,' whilst that adopted by Doubleday in the

[1] The American genus *Drasteria*, allied to *Euclidia*, and the American family *Focillidæ* are also very geometriform in their imaginal characters.

'Synonymic List,' and by Newman in his 'British Moths,' appears to be most unnatural.

It has often been asserted by Lepidopterists that no true systematic arrangement can be founded on larval characters alone, and this remark is to some extent correct, if we limit our comparisons to the *adult caterpillars* only, so that objections might perhaps be legitimately raised from this point of view to the suggested restoration of the older arrangement. But the case is quite different if, instead of comparing the adult larvæ, we study their comparative ontogeny. By this means, as explained in the previous part of this paper, we may gain an insight into the true relationships of the species. The first application of this principle to Lepidopterous larvæ was made by Professor Weismann, of Freiburg, in his 'Studien zur Descendenz-Theorie' (vol. ii., 1876), in which work the author has studied the markings of the larvæ of the *Sphingidæ* in great detail from this point of view. The whole subject is as yet almost in its infancy, and one of my chief objects in bringing this paper before your notice is to endeavour to convince you of the great necessity for paying attention to the earlier stages of caterpillars. No group of butterflies or moths has as yet been completely worked out in the manner in which Weismann has investigated the *Sphingidæ*, and till this is done for the whole order we shall never arrive at a truly natural classification. By making careful drawings of caterpillars at every stage of growth—using the microscope in the case of the youngest stages—all who are given to larva breeding may contribute substantially to the more scientific portions of our studies.[2]

I shall now adduce evidence to show that the larvæ of most of the Bombyciform Noctuæ are geometriform when young; the Geometriform Noctuæ are, as will be remembered, generally semi-loopers throughout life.

Among the earliest observations in this country is a note by Dr. Buchanan White (Ent. Mo. Mag., vol. v., 1869,

[2] The genus *Acronycta* specially claims to be thus worked out. See A. G. Butler in Trans. Ent. Soc., 1879, p. 313.

p. 204), in which he calls attention to the fact that the newly hatched larva of *Calocampa exoleta* possesses only three pairs of claspers. This was followed by a note by our member, Mr. Bernard Lockyer, who states that "most, if not all, of the larvæ of the Noctuæ belonging to the section *Genuinæ* have, when first hatched, but three pairs of claspers, the first two pairs being quite undeveloped; they are gradually developed as the larvæ increase in size, and by the third moult they are as large as the other pairs, and fit to be used in walking. Consequently, when first hatched, the larvæ are semi-geometriform, and loop more or less when in motion." ('Entomologist,' vol. v., 1871, p. 433). Mr. Lockyer gives the following list of species, which he had bred from the egg:—*Leucaniidæ*, *L. lithargyria*; *Apameidæ*, *M. Brassicæ* and *persicariæ*; *Caradrinidæ*, *G. trilinea*; *Noctuidæ*, *R. tenebrosa*, *N. festiva* and *brunnea*; *Orthosiidæ*, *T. gothica*; *Hadenidæ*, *E. lucipara*, *H. serena*, *A. nebulosa*, and *H. Chenopodii*; *Xylinidæ*, *X. lithorhiza*.[3] Among the *Heliothidæ*, *H. dipsaceus* appears to be an exception, the larva never possessing less than the usual number of claspers.[4]

The next observation to which I propose to direct attention is contained in a note published last year by Mr. Stainton (Ent. Mo. Mag., vol. xvii., 1880, p. 135), and referring to the young larva of *Triphæna pronuba*. Having received a batch of eggs for determination, Mr. Stainton observed that the young larvæ were half-loopers, and concluded that they were those of *Plusia gamma*. He was informed by his correspondent, however, that the eggs were those of *T. pronuba*, and, in order to have this view confirmed, he forwarded a batch of similar eggs to the well-known larva breeder, Mr. W. Buckler, of Emsworth, who reported that the larvæ were undoubtedly *T. pronuba*, and added some descriptive notes,

[3] Of this last species, Mr. Lockyer states that the larva "is especially geometriform when young, and has the habit of resting attached only by its claspers, with its body held straight out from the surface on which it is resting, after the manner of true Geometræ."

[4] This exception may be only apparent; in such doubtful cases it is advisable to extract the embryonic larva before it actually leaves the egg.

from which I take the following extracts:—In the newly hatched larva "the first two pairs of ventral legs are at first not in use, and but little developed, and the larva often rests in a looping position, and walks like a semi-looper." After the first moult they still looped in walking, the less developed first two pairs of claspers not being used. The Geometer-like habit appears to be abandoned in the fourth stage, *i. e.*, at the third moult. Mr. Buckler, who is perhaps one of the most skilled and experienced larva breeders in this country, adds further, that the larvæ of *Tæniocampa opima* are semi-loopers when young, and so also are those of *Phlogophora meticulosa*.

The next observation is of great importance as showing that a species which is a semi-looper when adult is more perfectly geometriform when young. In a recently published description of the caterpillar of *Euclidia glyphica*, Mr. G. T. Porritt remarks that the newly emerged larva "when walking arches its back like that of a Geometer." (Ent. Mo. Mag., vol. xvii., 1881, p. 210). When from an inch to an inch and a quarter in length they had lost the true looper style of walking, but were still half-loopers, having no claspers on segments 7, 8, 11, and 12. The above-mentioned note by Mr. Stainton has called forth some remarks in the current number of the 'Entomologist's Monthly Magazine' (vol. xvii., p. 237), by Mr. R. F. Logan, who states that, according to his experience, nearly all the larvæ of the *Trifidæ* are semi-loopers when first hatched. "The *Cymatophoridæ* are an exception, but they are altogether abnormal, and somewhat allied to the Tortricina, the eggs being pear-shaped, and the larvæ living between united leaves and moulting only four times, while the normal number of moults in the *Trifidæ* is five."

Turning now from native to American observers, I was fortunate enough to discover some corroborative evidence in Mr. C. V. Riley's Reports 'On the noxious, beneficial, and other Insects of the State of Missouri.' The following notes are taken from this author:—

Agrotis inermis, Harris. Newly hatched larvæ have "the

peculiarity of looping up the back when in motion;" this habit is lost after the first moult. (First Annual Report, 1869, pp. 73, 74.)

Leucania unipuncta, Haworth (the "army worm," = *L. extranea*, Guenée). Newly hatched larva has "two front pair of prolegs atrophied, so as to necessitate looping in motion." Still geometriform in second stage. In third stage looping habit lost, "but the front prolegs are still somewhat the smallest." In the fourth stage the claspers are of nearly equal size, and in the sixth stage the front claspers are said to be, if anything, longer than the hind ones. (Eighth Annual Report, 1876, pp. 184, 185.)

Leucania albilinea, Guenée. Newly hatched larva "quite a looper, the prolegs or joints 6 and 7 being still more atrophied, and those on joint 8 being short."[5] Looping habit lost in second stage. (Ninth Annual Report, 1877, pp. 53 and 56.)

All these facts point to the conclusion that the Noctuæ have been derived from geometriform ancestors, so that this group is phyletically younger, *i. e.*, has made a further advance in the development than the Geometræ. The geometriform sections of the Noctuæ are thus the more closely related to the Geometræ, and, as already insisted upon by Mr. Lockyer in the note referred to,[6] should therefore follow this last group, as in Stainton's list. The higher groups of Bombyciform Noctuæ (*Thyatira*) approach the Pseudo-Bombyces in the attitude assumed by the larva when at rest, as well as in the characters of the imago. If, therefore, the *Psychidæ* be referred to the Tineina, the following arrangement appears to me to best represent the existing state of our knowledge, although, of course, further investigations of larval ontogeny may lead to other modifications:—

[5] The author does not consider the head as the first segment, so that segments 6, 7, and 8 correspond with segments 7, 8, and 9 of English entomologists.

[6] Mr. Lockyer draws the conclusion that the Geometræ are "*undeveloped Noctuæ*," an expression which appears to me misleading, as it implies that the existing Geometræ are in course of transformation into Noctuæ.

Bombycidæ. (Including *Endromidæ* and
DREPANULIDÆ. *Saturniidæ.*)
PSEUDO-BOMBYCES.
NOCTUÆ.
TRIFIDÆ.
QUADRIFIDÆ.
GEOMETRÆ.
DELTOIDES.
&c.

The *Cochliopodidæ* appear to be most naturally placed between the *Hepialidæ* and *Nolidæ*. The natural affinities of the *Ægeriidæ* have been discussed by Mr. A. G. Butler (see Trans. Ent. Soc., 1878, p. 121), who comes to the conclusion that their true position is "after the *Pyrales*, and before the *Gelechiidæ*." The affinities of the *Cymatophoridæ* with the Tortrices may have to be expressed by the removal of this family from its present position, but more evidence on this head is required. Mr. Butler's proposed distribution of the species hitherto referred to the genus *Acronycta* among the *Arctiidæ*, *Liparidæ*, *Notodontidæ*, and *Noctuæ*, will be found in the paper referred to in Note 2.

The remarks which I have offered in this paper will, I hope, secure the restoration of the older method of arrangement in our cabinets, and at the same time lead to further work in the promising field of the comparative ontogeny of larvæ.

V. Stone Implements from the Neighbourhood of Chelmsford, Essex.

By Henry Corder.

[Read April 30th, 1881.]

Plate II.

About three years since a man who was formerly in our employ brought to me a very fine specimen of a Neolithic spear-head, dagger, or knife, measuring six and a half inches long by two and a half inches wide. It is very thin, and beautifully chipped, but not polished. Near one end are notches, three on one side and two on the other, apparently to serve as catches when binding the celt to the shaft or handle.

The specimen came from a gravel pit near the "Admiral's Park," Chelmsford; and the workman asserts that while standing at the bottom of the pit, and working at the gravel with a pole, he disengaged it from a seam of larger stones about twelve feet from the surface. The soil above is not very thick, so that there would be many feet of gravel above the implement. The celt has no signs of wear or of gravel stains upon it, and I am told that it could not have come from undisturbed gravel. In support of the one theory, I have the man's own statement that he poked it out himself from the stones which he considered to be undisturbed. This would be a seam probably almost free from the red ferruginous colour and adhesive qualities of ordinary gravel. At the spot in question the stratum is evidently, I think, valley gravel from the River Cann, about 200 yards from the bank, and perhaps thirty feet above the water level. In support of the other view, *viz.*, that the soil was not undisturbed, we have the assertion of a former owner of the pit that a quantity of bones of animals, and, I think, stags'

horns were found near by in the soil, tending to show that the ground might have been disturbed; and we have also to take into consideration the possibility of the man having made a mistake in determining the spot from whence the implement fell.

[As Mr. Corder's celt is a very beautiful example of a type by no means common, a figure is given of it, showing the front and side views. The specimen has been seen by Major-General Pitt-Rivers and by Mr. Worthington Smith.—Ed.]

I also exhibit a hammer-head made of an oval mass of sandstone, such as abound in our Glacial deposits. It is five inches long by three and a half wide, and has a hole apparently bored from both sides, as it slopes, crater-wise, from both surfaces to the middle. The ends of the stone give evidences of use, showing numerous slight chippings and irregularities. It was found in a yard at Writtle, Essex, having apparently been brought there from the fields with other stones for paving purposes.

The third small flint I exhibit was found near Chignal, Essex, by Mr. R. M. Christy, a member of the Club. It is three inches long and three-fourths of an inch wide. One side is polished, the other roughly chipped, and the stone tapers towards each end. The use to which it could have been put I do not know, but perhaps it may have been used as a *polishing* implement in dressing other stones.

West, Newman & Co. lith.

VI. Note on some Ancient Bronze Implements ("Socketed Celts") from the Neighbourhood of Little Baddow, Essex.

By Henry Corder.

[Read April 30th, 1881.]

About two years ago a man who was land-ditching at Little Baddow, near Chelmsford, on a farm belonging to Andrew Marriage, Esq., dug out a number of fragments of bronze at a depth of about two feet from the surface. There are in all twelve pieces, of which the following is a list:—

No. 1. A celt 4 inches in length, quite perfect. On the flat sides are five raised ribs ending in knobs.

Nos. 2 and 3. Celts $3\frac{3}{4}$ and $3\frac{1}{4}$ inches in length, unornamented. These also are perfect.

No. 4. A celt rather broken, about 3 inches long, ornamented round the socket with lines and zigzag work.

Nos. 5, 6, 7, and 8. Fragments of celts. One is tolerably perfect, with raised lines as in No. 1. Another appears to have had a double cavity inside.

No. 9. Portion of a blade. One side is sharpened, the other grooved with lines.

Nos. 10, 11, and 12. Lumps of unwrought metal. One which has been cut shows a red colour like copper.

The whole of these were found close together, and appeared to have been originally enclosed in some vessel which had decayed. It is interesting to notice that there are no two of them alike; the size or the ornamentation varies in every case.

VII. The First Night's "Sugaring" in England.—A Reminiscence of Epping Forest in 1843.

By James English.

[Read April 30th, 1881.]

In drawing up this little sketch of my first night's "sugaring" for attracting moths, I wish to state that I do not claim for myself any merit as the discoverer of this mode of collecting insects. The late Henry Doubleday, of Epping, had observed the fact that moths were attracted to empty sugar hogsheads that had been turned out of the warehouse. I had also noticed the same circumstance. The moths (which were usually of the most common species) came only in small numbers, and chiefly during the autumnal and rainy seasons; in the summer months the *Bees* in one fine day would clear out every vestige of sugar remaining in the casks. Although this fact was known to Henry Doubleday, the idea was never utilised by him for the capture of insects apart from the hogsheads. It was certainly myself who first applied "sugar" practically as a valuable adjunct to the net and lanthorn in the search for *Lepidoptera*. This experiment was made in the summer of 1843. Henry Doubleday was on his tour in France at the time. Previous to that year the only means used to capture *Noctuæ* was by the use of the old-fashioned clap-net, at the forest-side, hedgerow, or flowery meadow, where our little fluffy friends winged their way like fairy sprites as the evening softly fell, and the twilight deepened into night. But to net them was a difficult task, and our captures were often very meagre. Besides which the condition of the specimens was by no means good, and often before we could get them safely out of our gigantic nets the delicate beauty of the insects had vanished, the loosely attached scales being rubbed off against the rough leno. We had then no "cyanide bottles" to lull them gently into

sleep. The only fine and presentable specimens of the great *Noctuæ* tribes then shown in cabinets were obtained by breeding the insects from the caterpillars or pupæ, or by searching for the perfect moths on palings or trunks of trees. But the bulk of the *Noctuæ* in collections were miserable objects, and even the best cabinets exhibited frequent blanks. The discovery of the method of sugaring changed all that.

During the period already alluded to, the summer of 1843, *Noctuæ* were very abundant: much more so, I think, than they have been during late years. One fine evening I was walking about my garden, net in hand, when I noticed a number of *Noctuæ* flying over and settling upon a plum tree. I was soon busy at work, and at the close of the evening thought I had made up a good box; but of course the majority of the moths were in the usual plight, with thorax rubbed and wings abraded. I asked myself what was the cause of such numbers of *Noctuæ* congregating at that particular tree; no other tree in the garden was so patronised. On examining the plum tree the next morning, I was soon satisfied that the moths were attracted by the "honey-dew" with which the leaves were covered. The idea quickly occurred to me that sugar dissolved in water might be brushed on the leaves, so as to make a kind of artificial "honey-dew," which possibly would prove a good bait for our furry friends. As the evening approached I became eager to carry out my experiment. I brushed nearly all the leaves of the plum tree with sugar and water, and awaited the result. A more anxious time I never experienced in my entomological career. As the shades of evening crept on, *Noctua* after *Noctua* came in constantly increasing numbers, till the air around the plum tree seemed alive with moths, all soon settling on the leaves, and, to my great surprise, many cared not to fly away or even move.

I now brought my lamp, and, turning the light upon the tree, I beheld a scene such as I had never before witnessed except at sallow blossoms in spring, and the analogy held only in numbers, not in the variety of species which then gladdened my eyes. There were, of course, the usual garden

occupants, but amongst them were many uncommon species, doubly welcome by reason of their charming condition and freshness. The next day I told a friend of my extraordinary adventures with the night-flyers. We agreed to make a trial of the plan in the forest apart from the honey-dew covered trees. My friend had a quantity of old honey; to this we added some sugar, and wended our way to the woods with the liveliest hopes of a grand night. In the forest a place was quickly selected for this second experiment, and we brushed over with our sweets a large surface of foliage. We now went about "mothing" until the time arrived to light our lamps. Upon approaching our artificial honey-dew, as I might call it, I was even more surprised and pleased than the night before at the spectacle presented to us. *Thyatira derasa* and *batis* appeared like gems on the leaves. These had our attention first, both for their attractiveness and their active habits, always on the move. The next species to share our admiration was *Aplecta herbida;* we had never seen a *perfect* specimen before, so our delight may be imagined. *Aplecta nebulosa* swarmed; in fact, became a perfect nuisance, for, like *Xylophasia polyodon*, it is generally in such a fluster that it disturbs and frightens away a more valuable moth. *Apamea gemina*, a species not always to be had, was plentiful, and *Grammesia trilinea* swarmed, and with them were some specimens of the curious variety known as *bilinea*; at that time a good example was scarcely in any cabinet. The remainder of the scene was enlivened with *Noctua brunnea* and *festiva*, with the usual common species of the genera *Agrotis* and *Miana*; also the more welcome *Hadena adusta*, *H. thalassina*, and *H. Genistæ*, as well as many others. We returned home highly delighted with our excursion. As soon as our stock of honey was exhausted, we had recourse to sugar alone, and found it equally effective. Edward Doubleday was at this time at home, and had the charge of my captures to set out in the absence of his brother. He used to say "I wish my brother home to help me set your captures, you bring so many good things." On Henry Doubleday's return from Paris he was surprised in

the extreme, and sent for me to learn the details. After a few nights' adventures with sugar he wrote to the late Edward Newman, telling of the utilisation of sugar for the capture of moths. An article in the 'Zoologist' sent the entomological world to the woods with the sugar-can and lanthorn, and thus began the now well-known practice of sugaring by which our collections were rapidly enriched with new species, with rarities, and, above all, with good and fresh examples.

VIII. On the Formation of a Local Museum.

By J. E. Harting, F.L.S., F.Z.S., Member of the British Ornithologists' Union.

[Read May 28th, 1881.]

It was observed by one of the most fascinating of English writers on local Natural History, that if the natural productions of every district had their local historian, our knowledge of the fauna and flora of this country would become more perfect than by any other means; and every one knows how agreeably and how perfectly the author of that sentiment carried it into practice.

Living in a remote village in Hampshire, before the days of railways, with few neighbours of education to exchange ideas with, and but few books of reference on his favourite subject (for few then existed), he was thrown almost entirely on his own resources; and yet he found abundant occupation for many years in examining the productions of his own parish, and in collecting materials for those agreeable Letters on Natural History which have fortunately been preserved to us, and with which every one is, or ought to be, familiar. As an English classic, every student should read Gilbert White's 'Natural History of Selborne,' and it will be surprising if he be not first attracted, soon amused, then deeply interested, and finally filled with a curiosity and longing to observe and examine for himself some of the many remarkable things in nature which are therein only partly unfolded.

If it be true that a poet is born, not made, the same cannot be said of the local natural historian. His occupation is not to conceive beautiful ideas and clothe them with equally beautiful words; but to arrive at great scientific truths by a course of patient and careful investigation, and the judicious collecting of natural objects illustrative of such truths.

Of the first part of such a course we need not here speak; our present purpose is to offer some suggestions on the second; and in so doing we cannot dwell too emphatically upon the value of a local museum when containing well-arranged and properly named collections of the natural productions of the district in which it is situated.

The late Professor Edward Forbes expressed the opinion that it is to the development of provincial museums that we must look in future for the extension of intellectual pursuits throughout the land. Well-arranged museums of every kind are now, in fact, an educational necessity in every highly civilised State; and many such exist. But in how few of these do we find any portion of the museum set apart to illustrate the productions of the district? The very feature which of all others would give interest and value to the collections—which would render it most useful for teaching purposes, has in most instances been omitted, or so treated as to be altogether useless.

Unfortunately, many country museums are little better than raree-shows. They contain an incongruous accumulation of things curious, or supposed to be curious, heaped together in disorderly piles, or neatly spread out with ingenious disregard of their relations. In nine cases out of ten the only label attached to a specimen is "Presented by Mr. So-and-so;" the object of the presentation having been either to cherish a glow of generous self-satisfaction in the bosom of the donor, or, under the semblance of doing a good action, to get rid of rubbish that had once been prized, but latterly had stood in the way.

Curiosities from the South Seas, relics worthless in themselves, deriving their interest from association with persons or localities, a few badly-stuffed quadrupeds, rather more birds, some snakes in spirits, a stuffed alligator, part of an Egyptian mummy, a few Indian gods, a case or two of shells (the bivalves single, the univalves decorticated), a sea-urchin without its spines, a few common corals, the fruit of a double cocoa-nut, some mixed antiquities, partly local, partly Etruscan, partly Roman and Egyptian, and a case

of minerals and fossils—such is the inventory and about the scientific order of their contents.

The result of such an association as this of articles which have no sort of relationship with the rest, is to convert the whole into *rubbish*, using the word in the Palmerstonian sense of being "matter in the wrong place." Not that such museums, however, are absolutely useless. In default of better, they are useful, just in proportion as they encourage the collecting instinct in the beholders. But it will be admitted by those who are best able to judge that the only way to make a local museum what it should be is to decline with thanks all offers of foreign curiosities, and objects of which no history has been preserved, and to which, consequently, no value can attach, and to confine attention to the collection of natural objects procurable within the confines of the county to which the Society limits its researches.

It is useless to attempt to vie with larger and older museums by accepting everything that may be offered; for not only would such a collection probably never rise above mediocrity, and would occupy a great deal more space than would be required for the arrangement of locally collected objects, but from an educational point of view it would never be so valuable as a well-arranged series of minerals and fossils, animals and plants, collected within what may be termed the Society's area.

If for special reasons it should be deemed desirable to preserve within the museum walls other objects than these, they might be arranged in a separate department, and kept quite distinct from the educational series.

At the last meeting of the British Association, held at Swansea in August, 1880, Dr. Günther, in his presidential address to the Biological Section, referred in marked terms to the value of provincial museums when properly designed and arranged.

"The direct benefit," he observed, "of a complete collection of the flora and fauna of the district in which the provincial museum is situated is obvious, and cannot be exaggerated.

"The pursuit of collecting and studying Natural History objects gives to the persons who are inclined to devote their leisure hours to it a beneficial training for whatever their real calling in life may be; they acquire a sense of order and method; they develop their powers of observation; they are stimulated to healthy exercise.

"Nothing encourages them in this pursuit more than a well-named and easily accessible collection. This local collection ought to be always arranged and named according to the plan and nomenclature adopted in one of the numerous monographs of the British fauna and flora in which this country excels; and I consider its formation in every provincial museum to be of higher importance than a collection of foreign objects."

After such an expression of opinion from so high an authority as the Keeper of the Zoological Department in the British Museum, it will be unnecessary to dwell further on this part of the subject, although we may add briefly that such a museum, well carried out, is especially helpful to science in fixing a date to the fauna and flora of the district explored, and in giving the material means of contrasting it with the condition of both at a later period in the ever-changing circumstances of an increasing neighbourhood.

As to the mode of forming and arranging such collections as those contemplated, opinions will doubtless differ. The following suggestions are offered for consideration:—

In addition to such antiquities as may be discovered in the neighbourhood, and secured from time to time,[1] the three chief divisions or departments of a museum will correspond with the three great kingdoms—the Mineral, the Vegetable, and the Animal.

[1] Of such antiquities as are not to be obtained for the museum, drawings or photographs might be procured.

[In the Museum of the Essex Field Club no antiquities will be preserved, except such as may fairly serve to illustrate the subjects comprised in the department of *Pre-historic* Archæology. All other antiquities should be deposited in the museum of the Essex Archæological Society at Colchester.—Ed.]

The Mineral department may be arranged according to the successive strata, or layers, of which the soil consists. The several kinds of peat, sand, gravel, clay, &c., may be preserved in glass jars, and the various fossils which may be from time to time discovered should be arranged according to their position in the scale of animated beings.

The Vegetable department may have two leading divisions, the first comprising the non-flowering plants, as Lichens, *Fungi*, Mosses, and Ferns, sometimes called *Acotyledons* (without *cotyledons* or seed-leaves), or *Cryptogams* (concealed fructification, or seedless), because they do not bear manifest flowers, nor produce seeds containing an embryo, as do the great classes of *Dicotyledons* and *Monocotyledons*.

The second division comprises the flowering plants, and may have two leading subdivisions, illustrative of the two great classes into which flowering plants are to be found grouped in nature.

These subdivisions are named, according to the manner in which the wood is formed, *Exogens* and *Endogens*.

Exogens (producing outwards), so called from the new wood being formed in rings placed outside the old, are also called *Dicotyledons*, from the seed having two rudimentary leaves; the plants in their early condition, while yet enclosed in the seed, nearly always having two (sometimes more) small opposed lobes or leaflets. In this subdivision the parts of the flowers are most frequently in *fives* or *fours*, and the small veins of the leaves are usually irregularly netted, as *e. g.* in the oak and the beech.

Endogens (producing inwards), so called because the plants. having woody stems, form bundles of wood which do not usually increase in thickness year by year; once formed, they remain unaltered in diameter, scattered through the pith-like substance of the stem. In this class (also called *Monocotyledons* from the seed having only one rudimentary leaf) the parts of the flowers are usually in threes, and the veins of the leaves, excepting in a few orders, are parallel, or if diverging are not irregularly netted, as *e. g.* in wheat, grass, reeds, and rushes.

In the arrangement of the Animal kingdom the two leading divisions will be the *Invertebrata* and the *Vertebrata*—animals *without* and animals *with* vertebræ, or spinal columns. The invertebrate animals may be grouped in the following chief subdivisions, called "Sub-Kingdoms," viz.:—*Protozoa*, *Cœlenterata*, *Echinodermata*, *Vermes*, *Arthropoda*, and *Mollusca*. The vertebrate animals will, of course, comprise the Fishes, Reptiles, Birds, and Mammals.

With regard to the mode of preserving the various specimens of animals and plants which may be collected, we cannot do better than quote from a letter of the late Professor Bell, addressed some years since to the secretary of a local natural history society, who was at that time engaged in projecting a museum.

The quadrupeds which it would be necessary to preserve in any local museum are comparatively few and small. The Bats, which are the especial objects of interest, should be skinned and slightly stuffed, and may be pinned or attached with thread to small pieces of thin wood or cardboard.

Other quadrupeds, such as the smaller *Insectivora*, *Carnivora*, and *Rodentia*, should all be well and naturally stuffed, as well as the birds, and should be kept in closely glazed cases. Most of the Reptiles are better preserved in spirits. The skull of every quadruped should be preserved (by having the flesh removed, and being then macerated in cold water for some days), as well as the head and feet of the more remarkable birds.

The Bats, Voles, and Shrews, are objects of special inquiry, and collectors should endeavour to obtain specimens which would settle the question as to the identity or distinctness of several so-called species.

Fish, like Reptiles, are best preserved in spirit,[2] and by having a thread passed under or through the gill-covers,

[2] In this view we have ventured to differ from Professor Bell, who suggested the preservation of fish by taking off half the skin, sticking them on board, and varnishing them—a course which, for many reasons, is objectionable.

may be attached to the stopper of a glass jar, and so suspended in an upright position.

Land and fresh-water shells, like birds' eggs, are best kept in drawers, so as to protect them from the light, which would otherwise soon cause their colours to fade. The best way to free the shells from their inhabitants is to plunge them into boiling water, and keep them therein long enough to ensure death, when the animal is easily removed.

With regard to the collection and preservation of insects, every elementary work on Entomology gives full directions.

Plants should be dried between sheets of botanical drying-paper, which should be repeatedly changed during the process, and kept under pressure, and, when dried, should be attached by narrow strips of gummed paper to stouter white paper of a uniform size—folio is best—and kept in portfolios, or drawers. Palæontological specimens should be kept in glass cases to be readily observed, and careful notes made of the localities in which they have been found.

Every specimen, whether animal, vegetable, or palæontological, should have a ticket attached to it, on which its generic and specific names, locality, date, and name of the finder, should be legibly written; while any additional notes of interest should be entered in a book kept for the purpose.

One of the most interesting results of these local collections will be the light thrown upon the geographical distribution of plants and animals, and the relation between the geology of the district and its organised productions.

Having, then, briefly considered the uses and advantages of a local museum, and the simplest mode of collecting and arranging the objects to be preserved therein, it may not be out of place to offer some suggestions as to management, which will be best entrusted perhaps to a Committee and an Honorary Secretary.

The Committee having determined certain preliminary considerations, such as the housing of the collections, the question of Museum Funds, &c., it will be found desirable to adopt some such rules (amongst others) as the following:—

1. That all specimens, which must be in a good state of

preservation, and in a state calculated to keep well, shall be sent to the Honorary Secretary of the Museum Committee, accompanied by the name and address of the collector, the name of the object (if then determinable), the locality where, and the date when, collected, with any other details of interest, legibly written.

2. That a record of facts interesting in natural science shall be preserved in the museum.

3. That a list of plants and animals found in the district be drawn up for future revision and publication.

4. That an accurate register of the daily reading of the barometer, thermometer, and hygrometer, be kept in the museum.

5. That a descriptive catalogue be kept of the contents of the museum.

6. That by degrees, as the museum finances shall admit, a collection of works on natural science be formed and kept in the museum for the use of members and students visiting the museum.

Other rules, besides those here suggested, will doubtless occur to the Committee, or become necessitated by circumstances which are not here considered. Enough has perhaps been said to pave the way for a careful consideration of the question whether the formation of a local museum is not well calculated to give members of the Society and their friends an additional source of improvement, healthy recreation, and worthy occupation.

IX. Infusoria: What are they? Their Collection and Investigation.

By W. Saville Kent, F.L.S., F.Z.S., F.R.M.S.

[An Address delivered at the Field Meeting held at Chigwell, June 25th, 1881.]

It has been my privilege to accompany you this afternoon in your pleasant Field Meeting in the search for microscopic spoils, and more particularly to assist you, so far as circumstances would permit, in the collection of the special objects of my investigation, namely, Infusoria.

Although Jupiter Pluvius has unfortunately been so unpropropitious as to seriously interfere with our good intentions, I yet purpose now to address you briefly upon the more important features of this highly interesting organic group, trusting that the remarks I make may induce some, or, I would even hope, many, members of the Essex Field Club to embark also upon its systematic study.

It is in the first place desirable that I should place before you a concise definition of the series of organisms that, in accordance with our present knowledge, have to be included within the Infusorial world, such definition being requisite to enable the student to know what to accept and what to reject from among the multifarious forms that will present themselves to his notice at the very outset of his investigations, and which were actually comprised in the group by the earlier authorities. Even the latest complete treatise in the English language, Pritchard's 'History of the Infusoria,' that relates to this organic group, is based upon the lines laid down half a century ago by C. E. Ehrenberg, and includes, in a similar manner, a heterogeneous assemblage of animal and vegetal organisms belonging to half a dozen or more distinct classes (Diatoms, Desmids, Rotifers, Rhizopods,

Radiolaria, &c.), in no way connected with each other, and whose amalgamation with the Infusoria can no longer be seriously entertained.

The Infusoria, as now delimited, may be defined as microscopic, unicellular animals, or Protozoa, whose locomotive or prehensile organs take the form of one or more long whip-like appendages, or "flagella"; of variously developed fine hair-like appendages, or "cilia"; or of a more or less complete system of extensile and retractile tubular structures, or "tentacula." It is with reference to these three modifications of their appendages that the Infusoria are conveniently divided into the three primary sections, or classes, of the Flagellata, the Ciliata, and the Tentaculifera, to one of which groups the student must relegate the subject or subjects of his investigations as a preliminary step towards their specific identification. Out of these several classes the microscopist entering upon an examination of this fascinating organic series will do well, perhaps, to concentrate his attention firstly upon the class Ciliata, the majority of its members being of appreciable size and adapted for study and identification with comparatively low powers of the compound microscope. Confining his energies to this class, he will find that the organisms he collects conform to one out of four structural formulæ, which serve as bases for the subdivision of the class into as many subordinate groups or orders. Thus, in one very extensive series, the fine hairs or cilia are closely alike in size and character, and are distributed uniformly over the entire surface of the body. This order, known technically by the title of the Holotricha, is typified by the "Slipper Animalcules" (*Paramæcium*), common in infusions; the "Toothed Animalcules" (*Nassula* and *Prorodon*); and the "Swan Animalcules" (*Trachelocerca*). In the second order, that of the Heterotricha, the cilia—as the term implies—are of diverse kinds; those of the general surface of the body being very fine, as in the preceding group, to which, however, is superadded a much larger and stronger series which surrounds or conducts to the oral aperture or mouth. This order includes some of the largest

and handsomest representatives of the Infusorial class as exemplified by the Stentors or "Trumpet Animalcules," and the genera *Bursaria* and *Spirostomum*. In the third order, that of the Peritricha, the cuticular ciliary series is entirely suppressed, a spiral or circular series surrounding the anterior border, while a second supplementary girdle is occasionally developed towards the central or posterior region. This division is interesting as containing the exceedingly elegant "Bell Animalcules" or Vorticellidæ, all characterised by their normally sedentary habits, and being, as in *Vorticella* proper, attached singly to their fulcra of support through the medium of a complex retractile pedicle, or, as in the case of *Carchesium* and *Epistylis*, building up through repeated subdivision extensive tree-like colonies. Other Vorticellidæ, such as *Cothurnia* and *Vaginicola*, inhabit elegant stalked or sessile protective sheaths or loricæ, whose orifices are sometimes guarded by opercula or lid-like structures. Some one or more members of this very characteristic group reward a dipping from any weed-grown pond. The fourth and last group of the Ciliata is known as the Hypotricha; it includes all infusorial forms which, like *Euplotes*, *Stylonychia*, and *Oxytricha*, have locomotive cilia developed only on the lower or ventral surface of the body. These cilia are usually diversely modified in the same individual, taking the form of setæ, styles, or uncini, and constitute veritable ambulatory organs wherewith their possessors literally walk, insect-wise, over the surface of submerged objects.

The animalcules comprised in the relatively small group of the Tentaculifera—including *Acineta*, *Podophrya*, and their allies—were for a long while regarded as embryonic conditions only of certain Ciliata. The tables have now, however, been so far turned that not only are they recognised as constituting an independent series, but they are also shown to originate from ciliated germs, and consequently represent an even more highly developed class than that of the Ciliata. All the Tentaculifera are distinguished by their possession of tubular, and mostly retractile, tentacle-like appendages, which are utilised by the free forms for locomotive purposes, but

are more especially subservient in both the erratic and sedentary species as prehensile organs wherewith they seize and transfer to their own bodies the protoplasmic contents of other Infusoria. The animalcules belonging to the tentaculiferous class are not inferior to the Ciliata in regard to size, and on account of their chiefly sedentary habits afford peculiar facilities for systematic investigation.

Should the microscopical investigator be so far satisfied with his explorations among the ciliate and tentaculiferous classes of the Infusoria as to determine upon a like study of the Flagellata or monadiform animalcules, he will find his path beset by more formidable obstacles, though *en revanche* he will be entering on a new and interesting field that has up to the present time been so superficially explored that he may look forward with almost absolute certainty to meeting with an abundant harvest of species not yet placed on record in the scientific annals; while in connection with an overwhelming majority of those already known, but the scantiest data have been registered concerning their life and developmental histories. All the Flagellata are notable for their minute size, a total length of the 1- 2- or 3-1000th parts of an English inch being a common measurement. They consequently need the higher powers of the compound microscrope—a 1-8th inch objective and upwards—for their satisfactory investigation; while even with such apparatus a considerable amount of patience and manipulative skill is essential for the correct definition of the number and character of their diversely modified appendages. Up to within a comparatively recent date the Flagellata, as a clearly-defined animal group, could be scarcely said to exist, its members being intermingled with the unicellular flagelliferous Protophytes or lowest plants, and from which indeed they are even yet in many instances not easily distinguished. The application, nevertheless, of the standard that has been selected personally as the distinction between these flagellate Protozoa and Protophytes, namely, the capacity to ingest solid food and the possession of a rudimentary respiratory organ—the pulsating contractile vesicle—by the animals, and

the entire absence of such a faculty or structure among the plants, has rendered practicable the isolation of a very extensive series of animal forms, whose members, it is anticipated, may be almost indefinitely augmented. Even as so far known, the number of flagellate Infusoria is as considerable as that of the Ciliata, and promises in the long run to be transformed into a very substantial majority. A long and intimate acquaintance with the flagellate class has enabled me to propose its subdivision into three primary series, which may take rank with the several orders of the Ciliata already enumerated. The characters presented by these Flagellata are indeed far more substantial in kind than those cited in connection with the Ciliata. They relate not merely to the nature and distribution of the locomotive appendages, but to important distinctions in the characters of the ingestive system. Thus in one very extensive series, for which I have proposed the title of the Flagellata-Pantostomata, there is no distinct mouth or oral aperture, food-substances being received indifferently—after the manner of an *Amœba*—at all points of the cuticular surface. Such genera as *Monas*, *Heteromita*, or *Anthophysa* afford fitting examples of this Pantostomatous group. In a more advanced section or order the area of food-ingestion, while not distributed over the entire surface, nor so limited as to form a distinct mouth, occupies a discoidal interspace of considerable extent at the anterior extremity of the body. It is this order, distinguished by me by the title of the Choano-Flagellata, or "Collared Monads," that embodies those very minute and beautiful forms in which an extremely delicate extensile and contractile collar-like expansion embraces the base of the flagellum, and, through the adhesiveness and circulation of its substance, constitutes a marvellously elaborate and efficient trap for the capture of passing food. For the first discovery of this very remarkable flagellate group Science is indebted to Professor H. James-Clark of America, who, in the year 1866, figured and described no more than four distinct species. A few years later these several types were discovered by myself upon this side of the Atlantic, and, through the devotion of

further time to the study the number of known varieties has been augmented by me to little less than fifty. As shown in the drawings of the species herewith submitted,[1] the group abounds with forms which vie with, or even excel, in beauty and elegance of design the Peritrichous Vorticellidæ, whose dendritic colony-stocks and flask-like loricæ are moreover here reproduced, or more correctly pretypified, in bewildering variety.

In the third group of the Flagellata that has to be enumerated, differentiation has so far progressed that a distinct oral aperture is in all instances present. To this higher order, that may be appropriately distinguished by the title of the Flagellata-Eustomata (or "True-mouthed Monads"), belong especially the comparatively large *Euglenæ*, whose cloud-like multitudes, taken together with their brilliant colour, frequently constitute a conspicuous and important element in the superficial strata of our road-side ponds and ditches. In addition to the three typical flagellate orders already cited, there yet remain two or three numerically small series which connect these typical orders with either the class Ciliata, or with lower groups of the Protozoa. In this manner the order Cilio-Flagellata, as typified by *Peridinium* and its allies, directly connects the two classes of the Flagellata and Ciliata, its representatives possessing a conspicuous girdle of locomotive cilia in addition to a flagelliform appendage. The two small orders of the Rhizo-Flagellata and Radio-Flagellata, as instituted by myself, contain as yet but a few obscure forms (e.g. *Reptomonas*, *Rhizomonas*, and *Actinomonas*), which connect in a similar manner the typical Flagellata with the lower groups of the Protozoa, known as the Rhizopoda and Radiolaria.

A general outline of the limits of the Infusorial series being included in the foregoing remarks, a few of the more favourable conditions under which these microscopic organisms may be successfully sought for and studied may now be indicated. The most attractive and prolific hunting ground for

[1] [Being duplicates of plates illustrating the treatise, 'A Manual of the Infusoria' (Bogue), by the author, now in course of publication.—Ed.]

the student of Infusoria is undoubtedly furnished by weed-grown ponds. From these he may always expect to reap an abundant harvest. Fragments of the weeds, more particularly the finely divided varieties, such as *Myriophyllum*, *Ranunculus*, and the rootlets of Duckweed (*Lemna*), should be placed in a bottle and examined carefully for colony-stocks of the "Trumpet" and "Bell" animalcules, which may be easily detected with the assistance of a pocket lens, and may even be recognised as flocculent growths upon these plants with the unaided vision. Many of the free Ciliata, when abundantly developed, will also be rendered visible as glistening specks progressing through the water with that peculiar locomotive action distinctive of its kind. Excepting in the case of the social *Euglenæ*, and a few other types, whose presence, as already mentioned, lends a distinct coloration to the water, the collection of the Flagellata is pre-eminently an act of faith, and not of sight. Notwithstanding that the weeds gathered may appear to the unassisted eye, or even as examined with the pocket lens, completely barren, they may on submission to the higher powers of the microscope be found to be teeming with flagelliferous types. The collector, moreover, should be advised not to immediately throw away what appears on a preliminary investigation to be an unproductive gathering. Such gatherings often contain an abundance of latent germs, which after an interval of a few days develop luxuriantly on the surface of the plants, or on the sides of the receptacle that contains them. Two of the first and most remarkable flagellate types yet met with, *Rhipidodendron Huxleyi* and *Spongomonas sacculus*, as delineated in the exhibited plates ('Manual of the Infusoria,' pl. xvi., figs. 4–9, and pl. xii., figs. 17–23), were thus obtained fortuitously by myself from bog-water collected on Dartmoor, and which, as gathered and submitted to preliminary examination, betrayed no trace of abnormal infusorial life. Within a few days, however, little rust-red patches made their appearance upon the sides of the bottle, and developed within a brief interval into the colony-stocks, represented in the plates submitted; these were not only distinctly visible to the

unassisted eye, but had a diameter or total length of as much as from the one-tenth to the half of an inch. The inhabitants of these relatively large tree-like or sac-shaped fabrications in no case yielded a greater measurement than the 1-4000th or the 1-3000th part of an English inch, so that the number included in the larger aggregates is almost beyond calculation.

The student must by no means confine himself to the collection and examination of water-plants in his search for Infusoria. Innumerable forms are to be met with growing upon other aquatic animals: insect larvæ, molluscs, and the more minute Crustacea, yielding an abundance of different forms, their "fluffy" appearance, as seen with the naked eye or with the aid of a lens, being a sure sign of the presence of the required organisms. The little Entomostracan—*Cyclops*—may be more especially mentioned as commonly supporting on its body and limbs a perfect forest-like growth of infusorial types, including, it may be, representatives of each of the three primary sections referred to in my earlier observations. In this manner the class Ciliata is usually typified by one or more species of *Epistylis*; that of the Flagellata by *Cephalothamnium* and *Deltomonas*; while that of the Tentaculifera may be represented by one or two species of *Podophrya*; and all of which Infusoria, as so far known, are obtained under no other conditions.

Although ponds, ditches and other expansions of water may be recommended to the student as his first area of exploration, these represent but one out of numberless sources from whence Infusoria are to be derived. A multitude of species are essentially parasitic, living within the intestinal viscera of higher animals. Many terrestrial insects, worms, and molluscs, discharge the duty of hosts to special varieties. The frog, in common with other Amphibia, supports quite an abundant infusorial fauna, consisting of both ciliate and flagellate types; while even the higher Vertebrata, including horses, sheep, oxen, and man himself, are not exempt from infusorial dependents.[2]

[2] [An article descriptive of the chief varieties of parasitic Infusoria has been contributed by the author to the 'Popular Science Review' for 1880, p. 293.—Ed.

Artificial animal and vegetable macerations yield very numerous forms, and are especially rich in the flagelliferous Monads. Up to a comparatively recent date the derivation of the Infusoria produced so abundantly in hay infusions has been a marked subject of contention among physiologists, some arguing that they were generated there spontaneously, and others that they were developed from extraneously derived pre-existing germs. By carefully conducted experiments it has been my good fortune to successfully demonstrate not only that the germs or spores of Infusoria abound in hay previous to maceration, but also that the Infusoria which produced these germs flourish in the living condition in the grass previous to desiccation, remaining in a state of temporary encystment during dry weather, and reawakening to life with each shower of rain or fall of dew.[3]

A few concluding suggestions respecting the collection and observation of Infusoria may not prove unacceptable. From whatever sources samples of water containing specimens are derived they should be kept separate, and have a label indicating the place and date of collection affixed. Not only are species mingled indiscriminately prone to prey upon each other, but rare varieties may appear upon the scene whose precise habitat cannot be successfully traced after such admixture of the material collected. The student is advised to habituate himself to make drawings, however rough, of every species he encounters, placing by the side of each sketch a registration of its precise dimensions, taken with the aid of an eye-piece micrometer. The essential structural points that he should further seek to verify are the position and character of the oral and excretory apertures, and similar data with reference to both the contractile vesicle and the nucleus or endoplast if distinctly developed. The nature and distribution of the cilia or other appendages will, of course, receive primary attention; the precise number and

[3] [The whole question of biogenesis *versus* abiogenesis is fully discussed in chap. iv. of the 'Manual of the Infusoria'; and Mr. Kent's origina and valuable observations, above alluded to, are detailed at length at page 140, *et seq.*, of the same work.—Ed.]

relative length of these appendages in the flagellate class is of high importance, but is ascertainable in many cases only in connection with a prolonged and careful examination. The manner in which food is ingested by the Flagellata, whether by a distinct mouth or through the general surface of the body, should be accurately determined. Such observation may be greatly facilitated by the addition to the water of a little carmine or other pigment from an ordinary box of water-colours.[4] Special attention should be bestowed upon the reproductive phenomena. All Infusoria multiply rapidly by simple subdivision or fission, and it should be noted whether this fissive process takes a longitudinal, transverse, or oblique direction. Some forms give birth to living embryos, while among the Flagellata it generally happens that the whole body-mass splits up into spore-like elements. Sometimes this reproductive process is preceded by the fusion or conjugation of two or more animalcules. It should be the object of the investigator to ascertain and register as many data as possible connected with these several phenomena.

[4] [Until the last few years it was thought impossible to preserve most of the Infusoria for future study and reference, but Mr. Kent has elsewhere described ('Manual of Infusoria,' p. 113) the value of osmic acid as an agent for their conservation. A drop of the solution in distilled water (1 per cent. solution) should be placed on the covering glass before the latter is placed over the specimen. All structures, such as cilia, cirri and flagella, the internal endoplast, and in *Euglenia* and its allies, the colours also, are stated by Mr. Kent to be perfectly preserved. The animalcules thus killed may be fastened down as permanent preparations, without the addition of any other preservatives, and may be stained with the ordinary agents, hæmatoxylin, eosin, picro-carmine, &c., known to histologists. The objection to osmic acid is that it is very costly and excessively poisonous, its vapour having an intolerable odour, and attacking the eyes in a very painful manner. A solution of iodine in potassium iodide is without these objections, and acts in a similar, and almost equally efficient, manner. Another harmless agent is afforded, according to M. du Plessis, by a saturated solution of potassium permanganate; and for the preservation of the stalked Vorticellidæ very dilute spirit (1 in 10) is recommended. For manipulative details the student may usefully consult Huxley and Martin's 'Practical Biology,' Carpenter and Beale on the microscope, and Schäffer's 'Practical Histology,' in addition to Mr. Kent's *magnum opus*, above cited.—Ed.]

It may be finally submitted that no complete Infusorial Fauna of any one district in the United Kingdom has, up to the present time, been placed on record, and that it lies in the power of the members of a Naturalists' Field Club so favourably located as the one I now address to not only secure for themselves and their fellow-members an inexhaustible fund of instruction and recreation by a painstaking investigation of the Infusoria distributed throughout the Forest districts or the wider field of the County at large, but by following out such a study, sytematically and faithfully, they may materially benefit and advance the cause of Science in connection with a field of research having, as so far explored, a literally limitless horizon, and where it may advisedly be said, "the harvest truly is plenteous, but the labourers are few."

X. Report on the excavation of the Earthwork known as Ambresbury Banks, Epping Forest.

By Major-General A. Pitt-Rivers, F.R.S., President of the Anthropological Institute.

[Read at the Chelmsford Meeting of the Club, August 13th, and at the York Meeting of the British Association, September 5th, 1881.]

Plates III., IV., and V.

Epping Forest contains two camps about two miles apart, concerning which there are some local traditions. These camps owe their preservation to the fact of this region having been always forest and not cultivated ground; and this is a point worth noting on the part of those who are inclined to lay stress on the value of tradition as evidence of time and place. It is certain that neither Cæsar nor Boadicea, nor any of the heroes and heroines of olden times, to whom these things are ascribed, had any special eye for locating themselves in places which might not in after years be destroyed by the plough; yet tradition concerning these people hangs naturally about such places as remain to us from ancient times, rather than about those innumerable spots in our long and highly cultivated country in which ancient monuments have been destroyed by agriculture.

If anyone desires by practical experience to test the value of transmitted evidence, let him in the first place sit down, as I have done, to write a paper on Ambresbury Banks from materials derived almost exclusively from the notes of other gentlemen whose knowledge of the matter is greater than his own, and who having diligently watched the excavations made there, whilst he was otherwise engaged in London or elsewhere, have been good enough to supply him with all he has to base his paper upon. Let him observe how easy it

might be under such circumstances, by losing some of his notes and misinterpreting others, even in these days of developed intellect, with all the means of accuracy at command in writing, printing, mapping, lithographing, photographing, &c., to produce something which would have a strong affinity for nonsense concerning the matter in hand. Let him then suppose himself to be an ancient Briton deriving his information solely from oral sources. Let him assume that he has to tell his story not to the members of the Essex Field Club, but to a band of armed and painted fanatics strongly fortified with preconceived opinions, and determined to hear nothing which shall not accord with what they knew before. Let him then suppose his story has to be handed on by them to other savages furiously predisposed to different views, and that after that it has to serve its time for eighteen centuries as subject-matter for nursery and supper-table tales, each successive narrator clothing it, as the painters of the Middle Ages did the characters represented in their pictures, in vestments of their own particular time and place; he will see that the evidence afforded by tradition for any event of prehistoric or non-historic times having occurred in the particular locality attributed to it is unfit to hold any but a place of very secondary importance as an element of scientific investigation. I shall, therefore, make my apologies to Queen Boadicea for saying no more about her connection with this locality than has been said by others in papers that have been written upon these camps. There is no objection whatever, that I am aware of, to the supposition that Queen Boadicea made her last stand here against Suetonius, if anyone desires that such a theory should be held; but in this paper I have to deal solely with the materials unearthed from beneath the ramparts.

Two papers, both by Mr. B. H. Cowper, have been sent to me for perusal; one published by the Epping Forest Fund in 1876, the other read before the meeting of the Royal Archæological Institute at Colchester in the same year, The former is accompanied by plans of both camps by Mr. W. D'Oyley, of Loughton. To these I would refer the

reader for all that has been known about these camps up to the present time, as it appears to me undesirable to trench upon them by quoting passages which might deprive them of their proper place in the history of this investigation. Not having been the result of actual excavations they are necessarily speculative, but they have served to keep up interest in the subject, and may therefore be said to have contributed materially to the present results. I would, however, remark with respect to the Ambresbury Camp that the somewhat angular form given to it has not conveyed to my mind, as it appears to have done to some, the impression that it was the work of the Romans. Reference to Mr. D'Oyley's new plan, accompanying this paper (Plate III.), in which, at my suggestion, the shading of the slopes around the camp are given, will show that the configuration of the ramparts is adapted to the features of the ground.[1] On the east side a ravine (A) approaches the camp from the valley below, and divides into two forks (A B, A C) as it nears the camp; the rampart at this place is drawn across the points of these forks so as to sweep down them. On the south side also advantage is taken of another ravine (D) to strengthen the fortifications on that side. These are points which, although influencing the principles of defence which have prevailed at all times, are more especially British as distinct from Roman. The Romans, caring more for their internal discipline and the position of their cohorts than for external defence, arranged their camps on geometrically constructed lines, and often disregarded natural features altogether. It is true that at the northern corner (E) of Ambresbury Camp the rampart turns at an abrupt angle, but this is owing to the fact that at that particular spot there are no natural features to guide camp builders: the ground is a dead flat, and as the turn had to be made somewhere it was made abruptly, as so often occurs in British camps. An example of this is seen in the

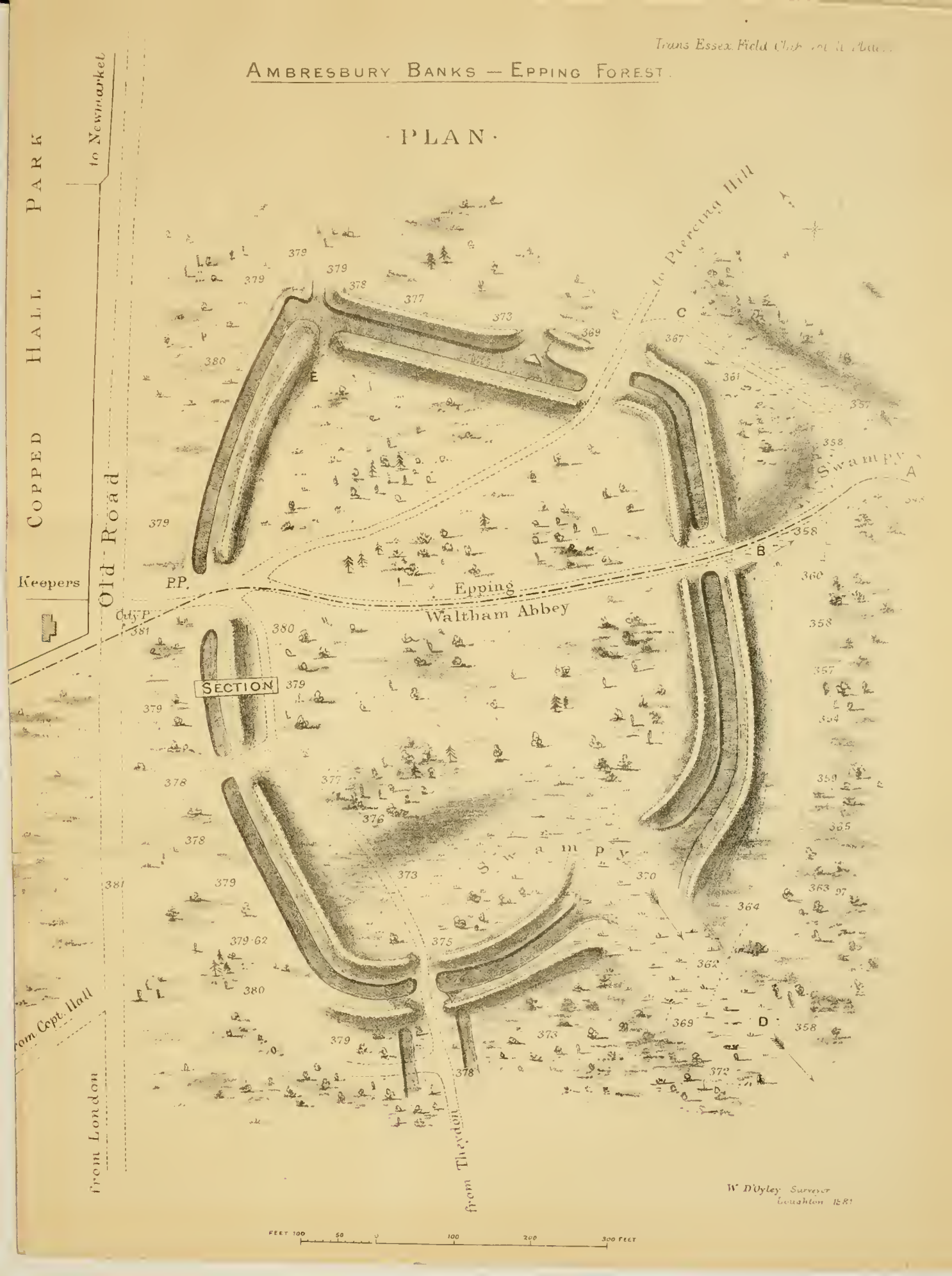
[1] [Levels were carefully taken by Mr. D'Oyley for the purpose of this investigation around and through the camp at distances of 100 feet or less. The results are given in the plan, the datum being, of course, one of the Ordnance bench-marks.—Ed.]

Camp at Seaford ('Journ. Anthrop. Inst.' vi. 287), which I have shown by excavations similar to the present to be British, and in many other British entrenchments that are known to me, when it became necessary to leave the natural line of defence which is determined by the ground and cut across the top of a hill, the turn was made abruptly. On this account I ventured at the meeting of the Society, which was held last year ('Proceedings,' vol. i., xxiv.), to say that there was nothing in the formation of this camp which predisposed me to regard it as the work of the Romans.

Mr. Meldola, the President of the Essex Field Club, having done me the honour of consulting me on the subject, I suggested at a meeting of the Club, held on 3rd July, 1880, that the only means of obtaining any further clue to the origin of the earthworks was by means of an excavation in the rampart. The exploration of other camps excavated has almost invariably brought to light relics which, though of little or no intrinsic value, were such as to afford certain evidence of date. When these camps were thrown up, in all probability large numbers of men were collected to do the work; these men encamped upon the ground previously to commencing operations, and strewed about the surface bits of broken pottery, knives, or various fragments of utensils in common use. The ditch was then dug on the outside, the materials from it were thrown up to form the rampart, and all that was lying on the surface was by this means covered up and preserved. A section through the rampart and ditch would reveal these objects; sometimes relics of interest are found, sometimes mere fragments and refuse; but in all the camps I have explored bits of pottery at the least have been discovered, which were sufficient to give some idea of the period of construction. The meeting above referred to having decided to adopt this course, a subscription was opened, and an application for permission to make sections through the ramparts was made to the Epping Forest Committee of the Corporation of London, and readily granted. It was decided to commence with Ambresbury Banks; a spot was selected on the west side of the camp

AMBRESBURY BANKS — EPPING FOREST.

· PLAN ·



which was bare of trees, and which afforded a good section of the earthwork, and the cutting was commenced on May 30th, 1881. (See 'Journal of Proceedings.') The excavation occupied about nine working days, and was carefully executed by four or five men in the employ of Mr. Cuthbert, contractor, Loughton. The section was 12 feet wide, extending from the foot of the silting of the interior slope to about 13 feet beyond the counterscarp; it included the removal of the rampart within those bounds down to the old surface line and the excavation of all the silting of the ditch, as well as the small outer rampart beyond the ditch, which at this place is only very slightly marked. The excavations were very carefully watched in relays by members of the Club during the nine days that the work lasted, including the President (Mr. Meldola), Mr. W. Cole (Hon. Secretary), Mr. W. D'Oyley (Hon. Surveyor), Mr. H. A. Cole, Mr. Alfred Lockyer, Mr. H. J. Barnes, Mr. N. F. Robarts, Mr. T. Fisher Unwin, Mr. W. Hodge, the Rev. Linton Wilson, Mr. F. H. Varley, and myself.

As it has been thought advisable by the Club that the programme which I drew up for the guidance of the directors of the excavations—being the result of previous diggings, and therefore possibly of use to future explorers—should be recorded, it is here inserted, together with the imaginary section accompanying it:—

"Let A, B, C, L, Fig. 1, Plate IV., be the original shape of the rampart; and L, D, E, F the original shape of the ditch. Then by denudation in the course of ages the outline will have assumed the line, G, M, N, I, W, the amount of denudation depending of course on the nature of the soil, the time, and various other causes. You will not have the advantage of a chalk soil in which the lines of demarcation of the different deposits are much more clearly defined than in most soils, and therefore you will have to look out sharply for them. In the references to the section I have named the different parts which are important in describing the positions in which the relics are found, as the evidence of date entirely depends upon that. A trench should be commenced well behind the

foot of the interior slope at S, as wide as you please, say ten feet, digging down to T, V, so as to be well below the old surface line G, L, Z, which in your soil will probably only be marked by a little white decayed matter representing the old turf. Whatever is found in the *body of the rampart*, A, M, N, L, and especially on the old surface line A, L, must be of the date of the construction of the camp or earlier; but things found in the silting of the interior slope, M, G, A, may be of various dates subsequent to the construction of the camp, the age of an object thus found depending upon its proximity to the old foot of the interior slope A. This is a very important point to notice, as any mistake between the *body* of the rampart and the *silting* would give an entirely false idea of the date.

"In like manner the ditch should be dug in spits down from the top. What is found in the upper spit is quite recent; the second spit older; and things of the date of the camp will be found only in the bottom spit.

"It will be found that the point I, marking the present centre of the bottom of the ditch, is always to the outside of the old bottom, K,—perhaps 3 or 4 feet, according to circumstances, but always outside,—more silting having gone from the rampart into the ditch than into the interior. I have had sometimes to dig down as much as 3 feet below G before finding the old surface line. The old surface in this place must have been very uneven at the time the rampart was made."

Fig. 2, Plate IV., is a section, by Mr. D'Oyley, through the centre of the cutting at Ambresbury Banks, showing the seams in the rampart and ditch, and the position of each object found. As the position of the objects in a vertical plane is all that is necessary to take notice of, everything is projected in this section. Each object as it was found was numbered, put into a small pill-box, ticketed on the spot, and marked on the section. At the conclusion of the excavations the entire collection was sent up to me for comparison with similar objects found in the ramparts of other camps. The following were the objects found:—

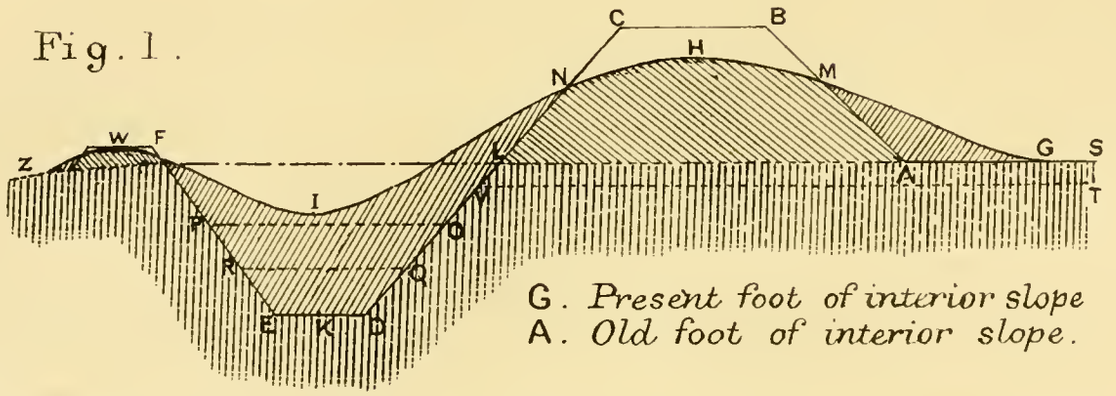
No. 1. An outside flint flake with bulb of percussion, and

IMAGINARY SECTION THROUGH RAMPART OF A CAMP.

Drawn by General Pitt-Rivers.

A.B.C.L. *Original Shape of Rampart*
L.D.K.E.F. *Original Shape of Ditch.*
G.L.Z. *Old Surface line.*
A.G.M. *Silting of interior slope.*
A.M. *Old interior slope.*
M.G. *Present interior slope.*
N.D.E.W. *Silting of Ditch.*
N.D. *Escarp.*
E.F. *Counterscarp.*

Fig. 1.



G. *Present foot of interior slope*
A. *Old foot of interior slope.*

A.M.N.L. *Body of Rampart.*
D.E. . . *Bottom of Ditch*
I. . . . *Present centre of Bottom*
K. . . . *Old centre of Bottom.*
N.O.P.F. *First spit taken out of Ditch.*
O.P.Q.R. *Second spit taken out of Ditch*
E.D.Q.R. *Third spit taken out of Ditch.*
T.V. . . *Bottom of Section through Rampt*

Silting

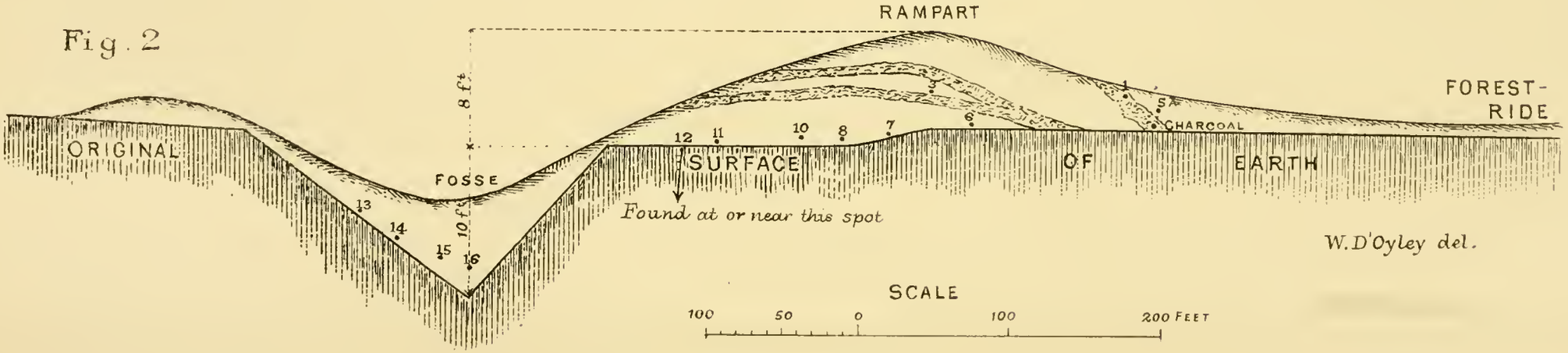
Body of Rampart.

Undisturbed Ground.

SECTION THROUGH RAMPART.

(Northern Face. — *Position of Objects found projected on one vertical plane.*)

Fig. 2



Trans. Essex Field Club. Vol. II. Plate IV.

another with one bulb and one facet. Found in the silting of the interior slope.

No. 3. One flint chip and piece of pottery, too much worn for identification. From the body of the rampart.

No. 5A. Piece of the rim of a pot, red on the outside and grey in the interior, without any grains of quartz or sand in its composition; the sides of the pot 0·40 inch thick, the rim projecting about 0·24 inch, and 0·34 inch deep. This might be Romano-British. Found in the silting of the interior slope at a spot where marks of burnt earth and charcoal indicated that a fire had been lighted at the foot of the interior slope when the rampart was intact. A representation of this fragment is shown in the chromo-lithograph, Fig. 1, Pl. V.[2]

No. 6. Piece, apparently, of pottery, resembling No. 3 in texture, but too much worn for identification; it had no grains of quartz in its composition. Found in the body of the rampart on the old surface line.

No. 7. Fragment of pottery about 1·25 inch square and 0·36 inch thick, brick-red on one side, which is the outside, and dark brown in the interior of the substance and in the inside of the pot; it has no grains of quartz in its composition. On the inside are striations, which might perhaps be the marks of the lathe turning on a potter's wheel, but the outside is uneven and shows no such marks. Found in the body of the rampart on the old surface line.[3] This fragment resembles fragments found at Cissbury Camp, near Worthing, and believed to be British or Romano-British, the red-brick colour distinguishing it from No. 5.

[2] [The Society is indebted to the author for this costly plate. General Pitt-Rivers, being of opinion that the objects found were typical of the *kind* of relics likely to be exhumed from similar earthworks, very generously added the chromo-lithograph to the Report for the information of future camp-explorers. The fragments themselves, with the other specimens described in the paper, will be deposited in the Museum of the Corporation of London, at the Guildhall.—Ed.]

[3] On further examination I am inclined to doubt whether these striations imply lathe turning, as the scratches are not perfectly parallel to one another.

No. 8. Fragment of rim, about 2 inches by 1½ and 0·40 inch thick; it has large grains of white and grey quartz, and red, grey and black pebble, in its composition; it is dull red on the outside and inside of the pot, and brown in the interior of the substance; the thickness of the pot is only slightly enlarged at the rim to about 0·42 inch, and the rim is a different shape from No. 5. It is hand-made, very uneven on its surface, and the rim rudely formed. Such a piece of pottery might safely be pronounced of British manufacture. Found in the body of the rampart on the old surface line. See the chromo-lithograph plate, Fig. 2, Pl. V.

No. 10. One flint flake or chip with bulb of percussion and one facet, and fragment of pottery about 2 inches by 1½ and 0·32 inch thick; brick-red on the outside and inside, and dark brown or black in the interior of the substance; no grains of quartz. Resembling No. 7 in quality; no marks of lathe. British or Romano-British. Found in body of rampart on or near the old surface line. See Fig. 3, Pl. V.

No. 12. Fragment of rim 1½ inch by 1 and 0·44 inch thick; dull red outside and inside, and red-brown in the interior of the substance; no grains of quartz in its composition, of smooth pasty texture; the rim projects more than No. 8, but is less evenly formed than No. 5. It is hand-made, and must be British. From the body of the rampart.[4] Fig. 4, Pl. V.

No. 13. A piece of much-corroded iron, about 2 inches long and 0·50 inch thick. Found in the silting of the ditch, about 2¾ feet beneath the surface, but too high up to be necessarily, or even probably, of the age of the construction of the camp.

No. 14. Piece of pottery, about 1 inch square and 0.18 inch thick, with small grains of sand in its composition, both thinner and harder than that found in the rampart, but much weathered; probably wheel-turned. It is of a uniform red-brown colour throughout, and was found 3 feet beneath the

[4] [On or near the old surface line; exact position unknown. Found by Mr. Fisher Unwin in examining the earth just thrown into the cart by the workmen digging out the old surface line spit.—Ed.]

Fig 4 N°12

Fig 2 N°8

Fig 5

Fig 3 N°10

Fig 1 N°5A

FRAGMENTS OF POTTERY FOUND IN THE RAMPART OF AMBRESBURY BANKS

surface in the silting of the ditch, but too high up to be necessarily of the age of the construction of the camp.

No. 15. Fragment of pottery, about 1 inch round and much weathered, 0·38 inch thick, brick-red on one side, the outside and the rest black; resembling some of the fragments found in the rampart. Found in the bottom of the ditch.

No. 16. A fragment of pottery, 0·68 inch thick, red on both sides and dark in the middle; too much weathered to enable any idea to be formed of its shape, bnt resembling No. 12 in composition. Found near bottom of ditch. In the same spot was also found a small fragment of a rim, 1·25 inch by 0·25 inch, and 0·24 inch thick; it appears to have been more evenly formed than some of the pieces in the rampart, but was unevenly baked, being red-brick on both sides and black in the middle; perhaps lathe-turned. Such a fragment might be Romano-British.

Besides the above there has been sent to me another fragment without any number, $1\frac{3}{4}$ inch by 1 inch and 0·34 inch thick. This was found near the marks of fire at the foot of the interior slope of the rampart, and therefore probably deposited there subsequently to the construction of the rampart. It is brick-red on the outside, and black on the inside and in the middle; it contains fragments of quartz and sand; it is harder than the fragments found in the rampart, and has distinct marks of lathe-turning in the interior or concave side. See Fig. 5, Pl. V. It is remarkable that this, the only fragment which can with certainty be pronounced to be lathe-turned, should be found in a position to lead to the inference that it may be of later date than the rampart; the only other piece which showed any indication of lathe-turning, and that doubtfully, being No. 7 (No. 5A. Fig. 1, the fragment which has the most evenly-formed rim, was found near the same spot as the fragment represented in Fig. 5, and was also in the silting of the interior slope). Grains of quartz or pebble do not necessarily indicate any period, as both the Romans and the Normans made pottery of this kind, but harder and better baked than the specimens under consideration. The rude construction of the pottery found in

rampart is shown by the difference of colour in the interior of the substance. This is due to imperfect baking, and implies a primitive condition of the art. Up to what period hand-made pottery was used in this country we have no means of knowing; but where the fragments are entirely hand-made it is reasonable to suppose it to be of early date. The two kinds of pottery found here—the smooth quality, with or without large grains of quartz, and the rough and sandy quality, often red-brick colour on the outside—have been found by me associated together in other camps; they are British or Romano-British, that is, British before or after the Roman Conquest. There is no ornamentation on any of the fragments found at Ambresbury Banks which would enable one to fix the date more precisely. Judging by their quality none of the pieces are Roman or Norman, and no fragment of Samian ware has been found. A single fragment of Samian pottery on the old surface line beneath the rampart would have determined the entrenchment to be Roman.

Although a few flint flakes have been found in the rampart they are not in sufficient number to prove with certainty that they were in use at the time of the construction of the rampart; they may have belonged to the soil, and have been turned up with it. They are usually much more plentiful in those camps which belong to the Bronze Age, for there can be little doubt that they were used late into the Bronze Age, if not more recently; and this fact alone appears to me to imply that this camp is more recent than the Bronze Age.[5]

The excavation of the silting in the ditch showed that it had originally been triangular in its section and pointed at the bottom, the escarp rising at an angle of 45°, and the counterscarp probably at the same angle, though now flatter; it was 22 feet wide at the top and 10 feet deep, and it has since silted up 7 feet from the bottom. The present centre of the ditch is now about 2 feet to the outside of the old

[5] Although a considerable number of flints were sent to me for examination, the majority, with the exception of those here named, were natural forms, and showed no evidence of human agency.

centre, and the present crest of the rampart has gone back some feet towards the interior owing to the greater denudation of the superior slope. The rampart must originally have been about 10 feet high above the old surface line; it is now 7 feet high, and the relief above the bottom of the ditch must have been 20 feet. The base of the silting of the anterior slope may be estimated at about 16 feet, and there is some indication in the seams of the old interior slope; but this measurement is uncertain, as is often the case in British ramparts. I have not usually found the bottoms of the ditches of British camps pointed. At Cissbury, Caburn, and Sleaford, there were flat bottoms along which the people might traverse, whereas in the earthwork improperly named Cæsar's Camp, near Folkestone, but Norman in its origin, both ditches were pointed like the present one; but we have no sufficient evidence as yet for determining whether there was any persistency in the form of ditches in British times. I have always assumed, however, that where the old sides of the ditches are found to stand at an angle of stability of 45°, as in the present case, it indicates that the entrenchment was intended to be more or less a permanent work. I should mention that my information as to the form of this ditch is derived entirely from Mr. D'Oyley's reliable section and from his verbal account of it, and not from personal observation, as I had left the camp before the bottom of it was excavated.

Whilst excavating the ditch the gentlemen present were struck with the number of rounded and apparently selected pebbles, 2 to 3 inches in diameter, which turned up in the silting near the bottom, and which led them to the conjecture that they must have been imported for use as sling-stones. This observation is the more valuable on their part from the fact that they were not aware at the time that like results had been obtained from other camps. In the Kentish and Sussex camps, I had found and recorded the discovery of similar pebbles in the ditches of works, facts which in those cases were the more noticeable owing to the soil being chalk, and so, therefore, not a pebble-producing formation. The pebbles in these places had been imported from the distant

sea-shore, whereas at Ambresbury they were probably obtained from Tertiary deposits close by. This independent observation, however, confirms the impression that slings were in common use by the defenders of these camps.

In conclusion I have only to add that, although at the request of the Council I have written the paper from the materials which have been furnished to me, it is to those gentlemen who have so diligently conducted the explorations the credit of this investigation is due: to Mr. Meldola, with whom the investigation originated; to Mr. W. Cole, the Honorary Secretary, by whom all the arrangements have been made; and more particularly to Mr. D'Oyley, the Honorary Surveyor to the Club—to whose excellent plans and sections on this no less than on former occasions the Society is indebted for the means of recording with accuracy the result of its labours. To these gentlemen my acknowledgments are due, not only as an honorary member of the Society for their contributions towards the matter in hand, but in a special manner for their courtesy to me in supplying the data and correcting the omissions which this paper may have contained.

If I am asked whether I consider the results of the investigation are conclusive, I can only reply that, within certain limits, the age of the entrenchment appears to have been fixed. I have on other occasions found it necessary to make three or four cuttings into the ramparts before satisfactory results could be obtained. If it be the wish of the Essex Field Club to settle the question whether the camp, being a British one, was erected before or after the Roman Conquest, further excavations can alone decide the point; but I think the Committee of Exploration may fairly be congratulated upon having, with the slender means at their disposal, achieved so much, having solved by means of a single section a large portion of the problem which has exercised the best wits of the neighbourhood from the days of Camden to our own time.

[As the excavated soil was removed it was carried to a spot a few yards from the scene of operations, and there

"clamped" for measurement. The desiccating action of the atmosphere soon rendered it friable, and as the clayey agglutinated lumps broke up, objects previously hidden in masses of earth could be more readily detected. Consequently, in the operations of carrying back the soil to the ramparts, the workmen lighted upon several pieces of broken pottery and two or three flint flakes, which were faithfully preserved and given into Keeper Butt's care, and by him duly handed to the Hon. Secretary. In this collection there are four or five pieces of pot of considerable size, as well as several smaller fragments, all presenting characters similar to the specimens enumerated in General Pitt-Rivers's Report. The larger shards may be thus described:—

a. Piece of Pottery irregularly triangular in shape, with a slight curvature inwards; about 2·75 in. long, by 1·7 in. wide, and 0·45 in. thick. Brick-red for about one-third of its thickness on the convex or outside, and very superficially so on the concave side, where the colour is not so rich and the surface probably less fired. Interior substance blackish brown, coarse in texture, with small angular fragments of pebble intermixed. Apparently a fragment of a vessel of considerable size.

b. Irregularly-shaped piece of pot, about 2·4 in. from corner to corner, by 2 in. broad, and 0·4 in. thick, with a slight curvature towards the inner or less-fired surface. Colour and texture in all respects like "*a*." On the convex surface are to be noted a few almost obsolete striations, similar to the markings referred to by General Pitt-Rivers in his description of No. 7 (page 61).

c. Small rimmed pot-shard, 1·2 in. by 0·8 in., about 0·40 in. thick at the rim, and about 0·25 in. at the thinner part. The rim is sloped-off towards the outside at an angle of about 45°. The colour is black throughout, except on the outer surface, where a very superficial brown-red tinge obtains. Texture somewhat harder than "*a*" and "*b*," and very different in character. Small fragments of quartz and grains of whitish pebble are abundantly intermixed.

d. Small fragment, 1·2 in. by 0·85 in., and 0·4 in. thick. Colour and texture similar to "*a*" and "*b*."

Various very small fragments like "*a*" and "*b*," and one corresponding in texture with "*c*," were found with the above. Two flakes may be recorded—one (*e*) of light-coloured flint, with indistinct bulb of percussion and three facets; the other (*f*) of darker flint, with good bulb and four facets: both specimens are about 1·5 in. long, and abruptly truncated at the end where the flaking-blow had been given.

It is much to be regretted that these specimens were not found *in situ*, so that their exact positions could have been marked upon the section; but it is almost certain that they came from well within the body of the rampart, judging from the positions in which they were discovered in the "clamped" excavated soil. The Editor has therefore thought well to describe them here, as they appear to afford valuable confirmatory evidence of the results obtained during the actual excavations.—Ed.]

XI. On the Origin and Distribution of the British Flora. With an Appendix on the River-basins of Essex as Natural-history Provinces.

By Professor G. S. Boulger, F.L.S., F.G.S.

[Read at the Field Meeting held at Danbury, August 13th, 1881.]

Last week will be memorable in the annals of British botanical science. Ten days ago I stood by the open grave of Hewett Watson, who devoted the genius and labour of his life to the elucidation of the geographical relations of British plants; and two days later appeared the eighth edition of Professor Babington's Manual,—a work that, in its critical discrimination of allied forms, has during the last thirty-eight years ably reflected the advance of Botany in England.

The work of these two men is related to the two divisions of the subject on which I am about to address you. First, I wish to trace the origin of our flora by comparing it with other assemblages of plants; and secondly, I wish to sketch the distribution of its constituents through the British Isles.

The most unobservant traveller cannot fail to notice the difference between the plants of one district and those of another. If it may not have fallen to his lot to contrast the luxuriance of a tropical jungle with the barren tundras of Arctic Siberia, or the pastures of our temperate plains with the pine forests of Scandinavian mountain-slopes, or the stunted birches and willows of their summits, he will have seen near his own home that the flowers of the field are not those of the wood, and that those of the sea-shore are not those of the river-banks.

Such experience leads us all at first to put down the distribution of plants as the effect of differences of climate—using the word in a broad sense; nor can it be denied that climate is a most important factor in the problem. You will,

however, I think, understand me when I say that climate rather determines what shall not grow in a given locality—what shall be exterminated if it attempt to grow—than what shall grow; if I remind you that plants do not always flourish most in their native home, as witness the familiar instance of the luxuriance of our English watercress and white clover in New Zealand, and that many plants do not occur native in climates admirably suited to them. In considering the causes which have led to our British flora being what it is, we must undoubtedly bear in mind that ours is an insular climate. There being more moisture in the air the extremes of both heat and cold are moderated, and our climate is better suited to herbaceous perennials than to annuals; but the recent separation of our islands from the continent causes their flora to be in the main an extension of that of Germany, altogether different from those "insular floras," rich in endemic or peculiar types, which characterise "oceanic" islands. The theory of evolution shows us that the real key to geographical distribution is to be found in the community of origin of allied forms, and their subsequent dispersal. The subject was first reviewed from this standpoint by Mr. Bentham in 1869.[1] He then pointed out that the vegetation of the globe must always have been separable into three great latitudinal zones,—the northern, the tropical, and the southern. The subsequent migrations of plants seem to have tended rather from north to south and from east to west than in the reverse directions.[2] In explanation of the

[1] In his Presidential Address to the Linnean Society.

[2] Sir Joseph Hooker, in his Address to the Geographical Section of the British Association at York, 1881, alludes to a lecture, by Mr. Thiselton Dyer, "On Plant Distribution as a field of Geographical Research" ('Proceedings of the Royal Geographical Society,' vol. xxii., 415, 1878), which I have not seen, wherein he argues that "the floras of all the countries of the globe may be traced back at some time of their history to the northern hemisphere." Sir Joseph also refers to Count Saporta's essay, entitled "L'Ancienne Végétation Polaire," in the 'Comptes Rendus', of the International Congress of Geographical Science for 1875, which also I have not seen. "Starting from Buffon's thesis, that the cooling of the globe having been a gradual process, and the Polar regions having cooled first, these

first of these lines of passage Mr. Darwin has suggested[3] that the northern forms existing in their own homes in greater numbers, owing to the greater extent of land in the north, have attained a higher stage of perfection or dominating power; but Dr. Asa Gray's[4] botanical confirmation of the truth of Bishop Berkeley's dictum that "westward the course of empire takes its way" remains at present an ultimate fact.

In seeking for the geological origin of our existing floras it seems of little use to travel backwards beyond the Cretaceous period. The flora of the Jurassic consists mainly of ferns, conifers and cycads, the oldest known dicotyledon being a species of poplar (*Populus primeva*), found in beds of Middle Neocomian age at Komé, in North-west Greenland;[5] the flora of this locality consisting in the main, however, of ferns and conifers, among the latter being the genus *Sequoia*. At the neighbouring locality of Atané a totally distinct flora is found,[6] in beds belonging to the Upper Cretaceous, and including, with few cycads, sequoias, and other conifers, a predominance of dicotyledons; among which are a fig, two magnolias, and plants apparently belonging to the orders

must have first become fit for organic life, Count Saporta proceeds to assume that the termination of the azoic period coincided with a cooling of the waters to the point at which coagulation of albumen does not take place, when organic life appeared in the water itself. . . . . The Polar area was the centre of origination of all the successive phases of vegetation that have appeared on the globe, all being developed in the north; and the development of flowering plants was enormously augmented by the introduction during the latter part of the secondary period of flower-feeding insects, which brought about cross-fertilisation."

[3] 'Origin of Species,' chap. xii., p. 340, in ed. 6.

[4] 'Darwiniana.'

[5] Professor Nordenskjöld, in a lecture to the Royal Swedish Academy, given in the 'Geological Magazine,' November, 1875, p. 529; and Professor Oswald Heer, in 'Flora fossilis Arctica,' Zurich, 1868—1875. For these and other references to the geological part of my subject I am indebted to an article on "The Cretaceous Flora," by Professor Morris, 'Popular Science Review,' 1876, pp. 46—59.

[6] Nordenskjöld, *loc. cit.*, and Dr. R. H. Scott, 'Geol. Mag.,' February, 1872, p. 71.

Proteaceæ and *Leguminosæ*. At La Louvière,[7] in Hainault, in clays belonging to the period of the Gault, is a flora consisting of conifers and cycads, like those of Kome and Folkestone; whilst at Aix-la-Chapelle,[8] in sands of Upper Chalk age, we have a far different assemblage of plants, including, with the ferns, *Asplenium*, *Lygodium* and *Gleichenia;* with *Sequoia* and other conifers, species of screw-pine and numerous *Proteaceæ* (amounting to nearly 70 species out of 200), some belonging to such genera as *Banksia*, *Dryandra* and *Leucospermum*, which are now confined to Australia and the Cape. With these are *Eucalyptus*, fig, bog-myrtle, willow, poplar, oak, and beech. In the lignites of the Dakotah group,[9] on the plains of Eastern Kansas and Nebraska, a remarkable flora has been discovered, embracing such forms as poplar, willow, birch, oak, bay, cinnamon, liquidambar, magnolia, tulip-tree, maple, and plum; and in New Zealand,[10] in beds also of Cretaceous age, we have the beech, with many representatives of the *Myrtaceæ*, and of genera still existing in that country. Professor Lesquereux is of opinion[11] that the existing arborescent flora of North America originated in the Dakotah group, and subsequently migrated to Europe. In the London clay, at Sheppey, we have fruits of Proteaceous

[7] Coemans, 'Mem. de l'Acad. roy. de Belgique,' tome xxxvi.

[8] Lyell, 'Student's Elements of Geology,' 1st ed., p. 278, Morris, *op. cit.*, pp. 49—51, and the numerous papers there quoted.

[9] Admirably described and discussed by Professor Lesquereux, 'The Cretaceous Flora,' Washington, 1874.

[10] Dr. Hector, 'Trans. New Zealand Institute,' vols. ii. and vi.

[11] *Op. cit.*, and 'Geol. Survey of Montana,' 1871, p. 314. Note also Mr. De Rance's remarks in the geological appendix to Sir George Nares' 'Narrative of a Voyage to the Polar Sea':—"In the overlying American Eocenes occur types of plants occurring in the European Miocenes and still living, proving the truth of Professor Lesquereux's postulate that the plant types appear in America a stage in advance of their advent in Europe. These plants point to a far higher mean temperature than those of the Dakotah group." "This," adds Mr. A. R. Wallace ('Island Life,' p. 183), "is very important as adding further proof to the view that the climates of former periods are not due to any general refrigeration, but to causes which were subject to change and alternation in former ages as now."

plants; and at Bournemouth this group occurs, with figs, bays, and *Papilionaceæ*, the whole presenting a subtropical and somewhat Australian aspect. It is, however, the luxuriant and wide-spread flora of the Miocene period that has chiefly forced upon geologists the question of climate in the past. At Œninghen, in the North of Switzerland, we have a flora including 465 species, of which 166 are trees and shrubs, half of them being evergreens. They comprise sequoias, cinnamons, tulip-trees, and many other American genera, together with maple, ash, plane, oak, and poplar.[12] At Breslau, at Dantzic, at Bovey Tracey, and in the Island of Mull, we have some of the same forms;[12*] but even in 70° of north latitude, on the west coast of Greenland, is a flora of a but slightly more northern character, including evergreens, a walnut, a plum, vines, and a magnolia;[13] whilst in Spitzbergen, more than 8° further north, occur water-lilies and swamp-cypress with pines and sequoias;[14] and even in Grinnell-land, within $8\frac{1}{4}°$ of the Pole, occur elms, guelder-roses, the Norway spruce, and the swamp-cypress.[15] The most satisfactory explanation of these wide-spread indications of a warm climate in north temperate regions is the theory, so ably advocated by Mr. Alfred Russel Wallace, in his most suggestive 'Island Life,'[16] of the lower elevation of the land within the arctic circle, and the access of warm currents from the Indian Ocean through the Red, Caspian and White Seas, and from the Pacific, to Polar regions. During the same period Professor Heer's valuable maps, in his 'Primeval World of Switzerland,'[17] indicate continuous land from North-west Africa through Spain, and the Bay of

[12] Lyell, *op. cit.*, pp. 190—198; Wallace, *op. cit.*, p. 177; and Heer, 'Flora Tertiaria Helvetia.' [12*] Heer, 'Miocene Baltische Flora'; Pengelly and Heer, 'Phil. Trans.,' 1863; Duke of Argyll, 'Quart. Journ. Geol. Soc.,' 1851; Lyell, *op. cit.*, pp. 214—223.

[13] Heer, 'Fossil-Flora von Alaska,' 1869; 'Flora fossilis Arctica'; Lyell, *op. cit.*, p. 215.

[14] Heer, *op. cit.*

[15] Wallace, *op. cit.*, pp. 177—179.

[16] Wallace, *op. cit.*, pp. 183—192.

[17] Translated by Mr. W. S. Dallas, London, 1876.

Biscay to the British Isles, to the importance of which I shall presently again allude.

Mr. Wallace has, I think, brought forward sufficient arguments to enable us to conclude that these geographical changes would prevent the recurrent glacial periods necessitated by Dr. Croll's hypothesis from having more than the local effect in the Flysch deposits between Switzerland and Vienna, and the ice-scratched boulders in the upper Miocene of Turin.[18] Directly, however, we pass to the Pliocene a cooling of the climate seems to have taken place, as seen in the pines and alders of the Cromer forest bed,[19] and the presence of the Arctic willow (*Salix polaris*) and the dwarf birch (*Betula nana*) in the clay deposit overlying the subtropical miocene lignite at Bovey Tracey.[20] The glacial periods probably then commenced with elevation which would cause a southerly extension of the ice and cold, driving the Miocene flora southwards. The more temperate species could then cross the Tropics along the chain of the Andes, and from the Caucasus through the Himalayas and the mountains of Aracan and Java to the north of Queensland. Probably, at a still earlier period, a migration had taken place along this last line, not only to Tasmania, but to New Zealand, the more modern flora of West Australia being then shut off by a central sea.[21] The period of elevation was

[18] Wallace, *op. cit.*, pp. 171, 172.

[19] Rev. G. Henslow, in "The Origin and Present Distribution of the British Flora," Trans. Watford Nat. Hist. Soc., vol. ii. (1879), p. 138.

[20] Henslow, *loc. cit.*, and Lyell, *op. cit.*, p. 221.

[21] "Thus the plants of Fuegia extend northward along the Andes, ascending as they advance. Australian genera reappear on the lofty mountain of Kinibalu in Borneo; New Zealand ones on the mountains of New Caledonia; and the most interesting herbarium ever brought from Central Africa, that of Mr. Joseph Thomson, from the highlands of the lake districts, contains many of the endemic genera, and even species of the Cape of Good Hope. Nor does the northern representation of the south temperate flora cease within the tropics; it extends to the middle north temperate zone; Chilian genera reappearing in Mexico and California; South African in North Africa, in the Canary Islands, and even in Asia Minor; and Australian in the Khasia Mountains of East Bengal, in East China, and Japan."—Sir Joseph Hooker's Address to the Geographical Section of the British Association (York, 1881).

followed by one of great depression, reducing Great Britain to an archipelago, in which only alpine plants would survive. Then followed a second continental period, readmitting the flora of Europe to the British Isles, but so rapidly succeeded by depression to present levels that, reckoning the flowering plants and ferns of Great Britain at 1425, only 970 had time to reach Ireland.[22]

As we travel eastwards from the Mediterranean, through the Levant, Caucasus, Persia, the Himalayas, China, and Japan, we find the traces of the retreating American Miocene flora more and more numerously. The fan-palm, the plane-tree, and the walnut of the East, and the magnolias of the Himalayas, China, and Japan, have the meaning of their distribution still more strongly brought out by the discovery of a tulip-tree in Central China.[23]

Mr. Bentham points out[24] that the northern flora has undergone a specialisation into three secondary floras, the Arctic-Alpine, the Temperate, and the Mediterraneo-Caucasian. The first of these, common in some degree to the Old and New World, has been driven into every latitude, surviving on the mountains when glacial gave way to warm conditions, often on their southern slopes. The Temperate flora consists largely of genera common to every longitude, easterly extensions of American groups, such as the deciduous trees; whilst the Mediterraneo-Caucasian, comprising six-sevenths of the species of Europe, and bounded by the deserts of Africa and Arabia, but having outliers on the mountains of Tropical Africa, may represent the remnant of the flora of Europe previons to the Arctic-Alpine and American Miocene invasions.

Whilst we are not concerned with the Tropical flora, that of the disconnected lands of the South has an important bearing on our present subject. In the West of Europe is a

[22] Hewett Watson, cited by Mr. Wallace, *op. cit.*, p. 320.

[23] Moore, 'Journal of Botany,' 1875, p. 225; Oliver, 'Natural History Review,' 1862; and W. T. T. Dyer, article "Distribution," Encyclop. Britan., 9th ed., vol. vii. (1877), p. 287.

[24] *Op. cit.*, summarised by Dyer, *op. cit.*

group of plants, including the gorses, broom, and allied plants, *Lobelias*, *Gladiolus*, *Sibthorpias*, and heaths, which are "more nearly allied to corresponding Cape species than they are to each other." The severity of the winter checks the extension of these plants to the East; and they seem to have travelled from Natal to Abyssinia, and from thence to the Cameroons and the Atlas Mountains. This migration may have taken place partly as a return current at the close of a glacial period; but it would seem more probable that some of these plants, now confined to Portugal, the Asturian Mountains of the north of Spain, and Ireland, are the relics of a still earlier migration, probably Miocene. Ireland may not have been so entirely submerged in glacial times as Great Britain.

The earliest botanical work of Mr. Hewett Watson was a pamphlet entitled 'Outlines of the Geographical distribution of British plants,' printed in 1832, in which he groups our flora under eight types of distribution, namely, British, English, Intermediate, Scottish, Highland, Germanic, Atlantic, and Local or doubtful. At the Cambridge meeting of the British Association, in the following year, Professor Edward Forbes, with his characteristic acumen, stated independently conclusions almost identical.[25] The plants of Watson's British, English, Intermediate, and Scottish types Forbes grouped under the name of Germanic. Those termed by Watson "Germanic" plants, found in the East and South-East of England, and mainly affecting a limestone or chalky soil, he termed Kentish; whilst of the seventy species constituting Watson's Atlantic group he separated eleven, namely, six species of Saxifrage, two heaths, Arbutus, Menziesia, Arabisciliata, occurring in Ireland, under the name of Asturian, from their nearest continental habitat; terming the remainder Armorican, from their affinity to the flora of Normandy and Brittany. Disregarding the accidentally associated Kentish group, and putting on one side the Local

[25] Afterwards elaborated into his memoir 'On the connexion between the existing Fauna and Flora of the British Isles and the Geographical Changes which have affected their Area.'—Mem. Geol. Survey, vol. i. 336.

and doubtful species, we may well adopt Forbes's title of Germanic, which applies to 1059 out of 1425 British species, since their extension into Scotland, or their exclusive occurrence in the higher latitudes of that country, are questions of secondary importance as compared with their continental distribution. For the Highland type, including 120 species, we may use the more general term of Arctic-Alpine, retaining the names Asturian and Armorican for two other types or subfloras.[26] With the exception of two or three waifs from America,[27] the whole British flora occurs on the Continent of Europe, as we might expect, considering the recent geological date of the separation of our islands. Though, however, the time which has elapsed since this separation has not been sufficient for local forms of specific importance to originate, it is quite possible that a minute study of what are known to botanists as critical species, such as the aquatic *Ranunculi*, the brambles, roses, hawkweeds, and willows, may disclose varieties that are not only peculiar to the British Islands, but to particular districts.[28] If then we wish to investigate the distribution of plants within the limits of Great Britain, we

[26] The revised classification will therefore be as follows :—

	Species.
Germanic (1186) :—	
British	532
English (including Forbes's Kentish) .	536
Intermediate	37
Scottish	81
Arctic-Alpine	120
Armorican	59
Asturian	11
Doubtful	49
Total No. of species on Watson's estimate . .	1425

[27] These are *Eriocaulon septangulare*, a North American species found in Skye, the Hebrides, and from Antrim to Connemara ; and *Spiranthes gemmipara*, also a United States plant, which occurs in County Cork.

[28] No doubt the closer comparison of English critical forms with those of the Continent will prove that many, if not all, occur in both districts ; still it can hardly be doubted that the distribution-areas of segregates will prove more limited than those of aggregates. This line of inquiry, which requires considerable acumen, is as yet almost untouched.

require a scientific division of the country into provinces. This I have attempted, so far as England is concerned, in a paper recently published by the Geologists' Association.[29] We could hardly have a better guide to critical botany than Professor Babington's 'Manual'; and for the systematic examination of the plants of our county we are fortunate in possessing Mr. Gibson's 'Flora of Essex.' In the appendices to this work Mr. Gibson compares the Essex list with those of plants found in the adjacent counties; and similar tables are given for Middlesex in Messrs. Trimen and Dyer's Flora of that county. Unfortunately the subdivisions adopted by Mr. Gibson are not the natural lines of watershed dividing the river basins. These undoubtedly afford the most scientific boundary lines, and in the botanical map of England in my paper, to which I have just alluded, Essex falls partly into three provinces—(1) the basin of the Thames and the South-East, including in this county the valleys of the Lea, the Roding, and the Marditch; (2) East Anglia, to which belong the valley of the Blackwater, in which we now are, that of the Colne and the Stour, and that of the Crouch; and (3) a small district near Saffron Walden drained by the great Ouse. Whilst I should not be sorry if our Club were the means of adding to the four British species peculiar to Essex, I should be still more glad to hear of the rediscovery of any of those plants which Mr. Gibson enumerates as lost, and shall be fully satisfied if my remarks are the means of directing the attention of a small number to the geographical relations of our plants.[30]

[29] "On the Geological and other causes that affect the Distribution of the British Flora," Proc. Geol. Assoc., vol. vi., No. 9.

[30] Among the authorities to which I have been specially indebted are Mr. J. G. Baker's 'Botanical Geography' (1875); Mr. Bentham's Presidential Address for 1869; Professor Morris's article, "The Cretaceous Flora" (1876); Professor Lesquereux's work with the same title (1874); Mr. Wallace's 'Island Life' (1880); the various works of Professor Heer, and of Mr. Watson; Professor Forbes's essay; Professor Dyer's article "Distribution" in the 'Encyclopædia Britannica' (1877); and Professor Henslow's paper, with the same title as the present one, in the Watford Society's Transactions for 1879. I have not yet seen Count Saporta's

Appendix.

On the River-Basins of Essex as Natural-History Provinces.

[Read September 24th, 1881.]

Plate VI.

At the request of our Secretary I have drawn a sketch-map of our county, divided, for purposes of Natural-History investigation, into provinces and subprovinces according to the river-basins, and have added the following explanations :—

Essex falls into three Provinces : those of (A) the Thames and South-east, (B) East Anglia, and (C) the East Fen and Secondary. Besides the narrow strip of land in the south of the county which drains directly into the Thames, in the first province are included that part of the county which drains into the Lea, the Roding, the Pym, the Ingrebourne, and other smaller streams. I may here remark on the difficulty I have found in obtaining accurate information as to minor streams. Those who live on their banks are ignorant of their names and of their courses. Like too many of the natural features of the country, they are beneath the notice of the county historian, and the writers of topographical articles and the draughtsman of small-scale maps think the brook that flows on for ever of less importance than such transitory accidents as noblemen's seats or parks, and accordingly omit it altogether, or, worse still, record it inaccurately. It would be a service to our society, and to the best interests of Essex, if some local member would draw up a thorough account of the topography of these small streams, the position, character and altitude of their sources, the area they drain, and their gradients. The article on Essex in the new edition of the

L'Ancienne Végétation Polaire' (1877), or Professor Dyer's lecture in the Proceedings of the Royal Geographical Society for 1878. Of course Sir Joseph Hooker's valuable Address to the Geographical Section of the British Association at York was delivered subsequently to this lecture of mine.

'Encyclopædia Britannica' affords hardly any information on the natural features of the county, and the drainage is barely alluded to in Mr. Gibson's 'Flora of Essex.'

I propose to divide the county into seven Sub-Provinces, viz.: 1, the *Lea* and *Stort;* 2, the *Roding;* 3, the *Crouch;* 4, the *Blackwater;* 5, the *Colne;* 6, the *Stour;* 7, the *Brook*. Of these the first two come within Province (A), that of the Thames and its tributaries. From the direction of its mouth and delta-deposits it seems that, were the sea-bed elevated, the Crouch, with its tributary the Roach, would unite with the Blackwater rather than with the Thames. I therefore class it in Province (B) East Anglia. The River Lea rises in the Chiltern Hills in Bedfordshire; flows south-east through Herts, the eastern two-thirds of which is drained by it and its tributaries, of which the Maran and the Beame are each about eleven miles in length. It then flows south to the Essex boundary near Roydon, where it receives the waters of the Stort, separates us from Herts down to a little below Waltham Cross, and then from Middlesex down to its outfall into the Thames at Bow Creek. Its total course is about fifty miles; but I have no information as to the acreage drained by it and its tributaries in Essex. The Stort rises within the Essex boundary between Little Chishall and Langley Mills, reaches the boundary between Stanstead Mountfitchet and Birchanger, and forms the boundary for the greater part of the remainder of its course to Roydon, receiving at Stanstead a stream (name?) from Chickney, giving its name to Bishop's Stortford, receiving the Pincey brook from Hatfield Forest near Harlow, and a Hertfordshire stream from the neighbourhood of Sawbridgeworth above Burnt Mill Station. Its total course is nineteen miles. Below Roydon the Lea receives the Cobbin River from between North Weald and Nasing, and from Middlesex Salmon's Brook from Enfield Chase and other streams from Hadley, East Barnet, Finchley, and Southgate, from Highgate and Hornsey (at Tottenham), and formerly the Hackney Brook at Old Ford. The Roding rises at Brook End near Easton, flows south by many villages to which it gives a name to Chipping Ongar, receiving a tributary

SCALE : 6½ miles to One Inch

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stream (name ?) from North Weald, then flows south-west to Chigwell and Woodford, and finally south-east past Ilford into the Thames at Barking Reach. Near Ilford it receives two streams from Hainault Forest, the upper of which seems to bear the name of Aldersbrook. The entire course of the Roding is stated by Gibson as 37 miles, and by the Ordnance Survey as 33 miles, the area it drains being 317 square miles.[31] The Pym or Bourne rises at Stapleford, flows past Havering-atte-Bower, Romford, and Dagenham, into the Thames at Halfway Reach. Next come three streams of doubtful nomenclature. One flowing west of Upminster and Rainham is marked "Ingreburn" in the 'Encyclopædia Britannica'; the second flows from between North and South Ockendon to the east of Rainham; and the third flowing from Thorndon Hall to Stifford and Purfleet is marked Ingrebury in Mr. Gibson's map, but flows past a hamlet named Childerditch. The name Ingrebourne probably belongs to the last. The River Roach, made up of streams from Hadleigh and Prittlewell and from above Rochford, flows mainly between Foulness and Wallasea Islands. Its basin, with that of the Crouch, includes 181 square miles. The latter river rises near Little Bursted, less than three miles from the sources of the Childerditch stream and the Wid, a tributary of the Chelmer, and flows eastward, having a course of 15 miles. It is doubtful if the name Blackwater is properly applied to more than the estuary of the great series of streams which drain 434 square miles out of the 1648 which Essex contains. In accordance with this view, the Ordnance Survey gives it a length of only 6 miles, as against Mr. Gibson's 46. The stream which rises near Wimbish, and runs by Bardfield and Shalford to Panfield, ought, at least so far, to be known as the Pant.

According to the best local authorities the stream should not be called Blackwater until it reaches the village of that name, half-way between Coggeshall and Braintree. The Survey gives the length of the Pant as twenty-eight miles. Below Kelvedon Mill, the Blackwater receives a stream there known

[31] [It may be remarked that the name of the river is always spelled "Rhodon" in Warner's 'Plantæ Woodfordienses.'—Ed.]

as Oyn's Brook. It rises north of the railway, in the parish of Feering, and is known as Domsey Brook until it enters East Thorpe. Thence it flows through Massing and Inworth to its confluence. Another small rivulet enters the Blackwater near here, on the same (left) bank. Rising on Tiptree Heath, in the parish of Messing, it flows north-west through Great Braxted and Inworth to the bridge below Gray's Mill, Kelvedon. At Rivenhall End another stream enters the Blackwater on the other side from Cressing. It is known as Cressing Brook, and lower down as Rivenhall Brook. Near Witham the Blackwater receives on its right bank a large tributary from Bardfield and Braintree. This is known as the Podsbrook, or below Braintree as the Brain, and, flowing past Black and White Notley, is inaccurately marked as the Blackwater in Mr. Gibson's map. The Blackwater enters the Chelmer navigation at Maldon. The Chelmer rises south of Debden, flows past Thaxted to Tittey, where it receives on the right bank a stream from between Chickney and the main source, to Dunmow, below which it receives a tributary from Lindsell and Stebbing, and so on to Chelmsford, where it receives the Cann. The Cann rises near Great Canfield and High Roothing, and flows past Good Easter and Chignal St. James to the Warren Farm, where it receives on its right bank a tributary (the name of which is unknown, but which might well be termed Roxwell Brook) that rises near Clerks, between Blackmore and Shellow, and flows through Roxwell. Nearer Chelmsford the Cann receives on its left bank a tiny stream from Brick Chignal, and on its right the important stream, the Wid. The Wid rises near Thorndon Hall, Brentwood, flows to Mountnessing, where it receives another stream partly from Navestock, and partly from Blackmore and Doddinghurst (name ?), on to Margaretting, Widford, and its confluence with the Cann. The length of the Wid is stated at thirteen and that of the Cann at ten miles. Below Chelmsford the Chelmer receives, at Little Baddow, two affluents on opposite banks; on the north or left bank one from Holt's Chantry; on the south one from Preston, Haningfield and Sandon; and lower down the more important

River Ter. The Ter rises near Felstead, flows on to Fairstead, where it receives a stream from Black Notley, and to Terling, to which it gives a name, its course to its affluence being twelve miles. The entire length of the Chelmer to Maldon is stated by Gibson, probably accurately, as thirty-four, by the Survey as twenty-nine, miles. The estuary of the Blackwater receives four principal streams, two from the south from Woodham Mortimer and Haseleigh, and on the north one from the Tothams and the Lime Brook from the Tolleshunts.

The district south of the high road from Snoreham to Bradwell, drained by rivulets running to Danesey Flats, I consider as part of the valley of the Crouch; but the twenty-four square miles north of the river-mouth, classed apart by the Survey as "small streams," including Virley and Salcot Marsh, I group in the Blackwater Basin. Mersea Island falls most naturally, perhaps, into the Colne district. The Colne Basin includes 407 square miles, and the length of the river—which rises near Bumpstead and Birdbrook, and passes E.S.E. by Yeldham, Hedingham, and Halstead, to Colchester and Mersea Island—is thirty-six miles, according to Gibson, and, probably in fact, but only twenty-four according to the Survey. At Colne Engaine it receives, on its south or right bank, a stream from Weathersfield and Gorsfield, and lower down, on its left bank, one from Pebmarsh. Below Greenstead an affluent enters it from Several Hall, and above Fingrinhoe, opposite Wivenhoe, it receives the Roman River. This stream rises between Earl's Colne and Great Tey, and is first known as Tey Brook; flows past Aldham, where it is called Aldham Brook, to Stanway, below which it bears the name of Roman River, and near Abberton receives the Layer Brook from above Layer Marney. The fifty-three square miles between Colchester and Walton mapped by the Survey as drained by such streams as those from Bromley and Bentley, and the Holland Creek, I place in the Colne sub-province; but the neighbourhood of Oakley and Wicks belongs to the Stour drainage.

This latter river rises in the south-west of Suffolk, on the

Cambridgeshire border, and flows eastward to Wixoe, where it begins to form the boundary between Suffolk and Essex. Its drainage-area is variously stated at 430 or 407 square miles, most of which is in Suffolk, and its length as 45 or 55 miles: probably the smaller number is the true one in each case. Its chief tributaries are the Suffolk rivers, Brett, Boxford, and Orwell, but from Essex it receives four small streams: one above Sudbury, from Ovingten, Wickham St. Paul, and Belchamp Water; another below Bures, from Pebmarsh; a third at Neyland, from West Wood Green; and, below Langham, one from Boxted Heath.

In the seventh and last sub-province, the Brook rises between Debden and Ugley, and flows northward, receiving the water from Debden Lake, through Quendon, Newport (where it receives a stream from Arkesdon), Wendon (where it receives another, also on its left bank, from Chishall and Wendon Lofts), and Audley End, where it receives the Slade, to Chesterford, where it leaves the county. The Slade rises between Hadstock and Little Chesterford, and flows under the town of Saffron Walden. The Brook is a tributary of the Cam or Granta, and is spoken of by both these names. Probably Granta is merely a scholastic form of the name Cam, as Isis has been coined at the sister University. The main stream of the Cam rising in North Hertfordshire is sometimes termed the Rhee. The question as to which of these sources and streams is the main river is, like that between the Churn and the Thames Head Brook, one of no real importance or possible solution. Such being the principal watercourses of the county, my sub-provinces depend upon their watersheds, as follows:—

Sub-province 1—*Lea and Stort.* From 7, by line from Little Chishall to Langley, Rickling, Ugley, and Henham-on-the-Hill; from 2 and 4, by this line continued to Broxted, Little Canfield, White Roding, High Laver, North Weald, Epping, High Beach, Walthamstow, Wanstead, East Ham, and North Woolwich.

Sub-province 2—*Roding and Small Thames affluents.* From 4, by line from Broxted, through Easton Park to High Easter,

Good Easter, Shellow Bowells, Stondon Massey, Navestock, South Weald, Brentwood, and Thorndon Hall; and from 3, by this line continued to Langdon Hills, Vange, and along the high road to the river at Southend, including Canvey Island.

Sub-province 3—*Crouch.* From 4, by a line from Herongate, Thorndon Hall, to Billericay, Downham Green, Hillhouse, Woodham Ferrers, Norton Cold, and along the high road to St. Peter's Church, Bradwell.

Sub-province 4—*Blackwater.* From 7, by a line from Henham-on-the-Hill to Debden and the county boundary near Cut Bush, Ashdon. From 5 and 6, by a line from Bumpstead to Weathersfield, High Garret, Marks Hall, Little Tey, Messing, Inworth, Primrose Hill, Tolleshunt Knights, Hyde Farm, Great and Little Wigborough.

Sub-province 5—*Colne.* From 6, by a line from Broad Green, Bumpstead, to Ridgwell, Little Yeldham, Crouch House, Catley Green, Garlands, Counters Cross, Highfield, West Wood Green, Ardleigh, Bradfield House, Wicks Cross, Stone Cross, and Great Oakley.

Sub-province 6—*Stour*, and *Sub-province* 7—*Brook*, are thus already defined.

As compared with Mr. Gibson's divisions, my sub-province 1 comes in his 1, 3, and 4; my 2 in his 1 (very little), 3, 4, and 5; my 3 in his 5 and 6; my 4 in his 1, 2, 3, 5, 6, and 7; my 5 in his 1 (very little), 2, 7, and 8; my 6 in his 1, 2, and 8; and my 7 entirely in his 1.

Thus, making another much urged alteration, *viz.*, substituting abbreviated names for initials, Mr. Gibson's localities for *Clematis Vitalba* will run, when re-arranged, as follows:—

1 ?—2. Little Warley, *Hind.* Tilbury, *Newb.* Southend, *Ibbot.* Romford, *Ibbot.*—3. Rochford, *Ibbot.*—4. Chelmsford, Broomfield, Boreham, *Pigg.* Kelvedon, Rivenhall, *Varen.* Maldon, *Ibbot.*—5. Halstead, *Bent.* Copford, *Bab.* Colchester, *Garn.*—6 ?—7. Common in the Walden district, *Gibs.*

To recast the whole of this valuable work in the manner thus proposed would be a labour of considerable difficulty.

In conclusion, I have to acknowledge my indebtedness to R. M. Christy, Esq., of Saffron Walden, and E. G. Varenne, Esq., of Kelvedon, for many valuable local corrections. I have thought it useful to append a table of the rivers and their tributaries, giving lengths where known. R. = entering on right bank; L. on left. [ ] square brackets signify that the stream is not in Essex. " " inverted commas denote provisional names.

LEA. 50 miles.
- [R. Maran. 11 m.]
- [R. Beame. 11 m.]
- L. STORT. 19 miles.
  - L. "Chickney Brook."
  - L. Pincey Brook.
  - [R. "Sawbridgeworth Brook."]
- L. Cobbin River.
- [R. Salmon's River.]
- [R. "Hadley Brook."]
- [R. "Hornsey Brook."]
- [R. Hackney Brook.]

RODING. 33 miles.
- R. "North Weald Brook."
- L. Aldersbrook.
- L. "Ilford Brook."

PYM or BOURNE.

"UPMINSTER BROOK."

"RAINHAM BROOK."

INGREBOURNE.

CROUCH. 15 miles.
- R. Roach.

CHELMER. 34 miles.
- R. "Tittey Brook."
- L. "Lindsell Brook."
- R. CANN. 10 miles.
  - R. "Roxwell Brook."
  - L. "Brick Chignal Brook."
  - R. WID. 13 miles.
    - L. "Doddinghurst Brook."

L. "Holt's Chantry Brook."
R. "Haningfield Brook."
L. Ter. 12 miles.
L. "Fairstead Brook."
L. Blackwater or Pant. 28 miles.
L. Oyn's or Domsey Brook.
L. "Tiptree Brook."
R. Rivenhall or Cressing Brook.
R. Brain or Podsbrook.
R. "Woodham Mortimer Brook."
R. "Haseleigh Brook."
L. "Totham Brook."
L. Lime Brook.
Colne. 36 miles.
R. "Gosfield Brook."
L. "Pebmarsh Brook."
L. "Greenstead Brook."
R. Roman River, Tay, or Aldham Brook.
R. Layer Brook.
Stour. 45 miles.
R. "Belchamp Water."
R. "Bures Brook."
R. "Nayland Brook."
[L. Brett. 17 m.]
[L. Boxford.]
[L. Orwell and Gipping. 32 m.]
Brook or Granta.
L. "Arkesdon Brook."
L. "Wendon Brook."
R. Slade.

Addenda and Corrigenda to p. 80.—Line 13, after "Bedfordshire" add "in Seagrave Marsh, near Dunstable"; l. 17, after "Roydon" add "and Hoddesdon"; l. 20, after "fifty" add "five"; l. 23, after "Mills" add "near Clavering"; l. 2 from bottom, after "Easton" add "above Little Canfield."

XII. On the Land and Fresh-water Mollusca of the District around Colchester; a contribution towards a list of the Fauna of Essex.

By Henry Laver, M.R.C.S., F.L.S.

[Read September 24th, 1881.]

The distribution of the Mollusca of a district depends so much on its geological features that no excuse is needed in prefacing an account of the Conchology of Colchester by giving its geological conditions. The town itself, south of the River Colne, is situated on sands and gravels, and the same soil is continued for five miles from that river in the southerly district, and also for four miles to the west of the town, as well as for two miles on the east. Beyond this distance, in the latter direction, there are clays, sands, and gravels of the Tertiary formations. Southwards the sands and gravels are succeeded by London Clay, and westwards by Boulder Clay and Brick Earths, as at Copford, where are the well-known brick pits and the remarkable deposit of Shell Marl. North of the town, after crossing the river valley, London Clay appears again, and continues until the Stour is approached, when sand is the prevalent formation.

From this short sketch it will be seen that geologically the district is one from which many molluscan forms will be wanting. There is an entire absence of bog, and on the whole the district may be considered dry; but it is fairly timbered, and contains a few woods, principally composed of oak. The greater part is under the plough, and there are no commons worth mentioning. With all these unfavourable conditions, I think the following list will prove that we are richer in species than might have been expected.[1]

[1] [The number of species enumerated by Mr. Laver within his district is 75, compared with 121 species given by Jeffreys in 'British Conchology' as the total number of Land and Fresh-water Molluscs at present inhabiting Great Britain.—Ed.]

The Colchester district is watered by three rivers, the Colne and Blackwater wholly in Essex, and the Stour dividing this county from Suffolk. Its boundaries are a line drawn from Bures, through Coggeshall to Maldon, on the west side, and on the east, south, and north the sea and rivers form its confines.

The names and arrangement adopted in the paper are in accordance with Mr. J. Gwyn Jeffreys' 'British Conchology.'[2]

Sphæriidæ.

Sphærium corneum, Linn.—As is usually the case, this is abundant in all the streams and ponds which are suitable. I find it most variable, but I cannot satisfy myself that we possess more than one of the varieties named by Jeffreys.

Var. *flavescens* occurs in the most rapid parts of a brook two miles south of the town.

S. lacustre, Müll.—Occurs in many ponds, on gravel as well as clay, and it is surprising how they manage to exist in the stagnant and filthy water of some ponds.

Var. *Brochoniana*.—This form I find in the remains of the moat of an old manor house at Birch, on Boulder Clay.

Pisidium amnicum, Müll.—Although usually so common, I cannot say that I find it abundantly; perhaps I have not the knack of searching for it.

P. fontinale, Drap.—In the marshes of the Colne, &c., but not abundantly. I do not think we have any of the named varieties, but I find the shell to be very variable.

P. pusillum, Gmelin.—Very abundant in shallow roadside ditches which are dry for months at a time. This also is a variable species, some specimens being nearly round, *i.e.*, more ventricose than usual.

P. nitidum, Jen.—I do not find it abundant, but still the river meadows generally seem to have some in most of the ditches at one part or other. The long grasses growing in

[2] 'British Conchology, or an account of the Mollusca which now inhabit the British Isles and the surrounding seas.' Vol. i. Land and Fresh-water Shells. London, 1862.

the water beside the drinking-places for cattle I find most productive.

I consider this to be a most unsatisfactory family, and question very much whether it will not be necessary to reduce the number of species to three, and call the others varieties.

Unionidæ.

Unio pictorum, Linn.—I have seen shells of this species from the river at Coggeshall, but I have never taken it myself. They were the ordinary form, and I do not think it occurs elsewhere within my boundaries.

Anodonta cygnea, Linn.—In every stream and many ponds.

Var. *radiata*.—In almost stagnant ponds; at Bromley Lodge very large specimens occur, but I think the shells are thinner than in the normal form.

A. anatina, Linn., appears to me to be only a variety of the above. The intermediate forms are many, and I think it is only a question of food. I have stocked a suitable pond with *anatina*, and hope one day to note the result.

Neritidæ.

Neritina fluviatilis, Linn.—Plentifully on stones in all our streams. The markings are very varied.

Paludinidæ.

Paludina contecta, Millet.—In the Stour the specimens are very large, but I do not find it to be an inhabitant of any other stream.

Bythinia tentaculata, Linn.—Very frequent in both running and still waters. The most abundant fossil at Copford.

B. Leachii, Shepp.—Occurs in the same habitats as the last species, but is much less abundant.

Valvatidæ.

Valvata piscinalis, Müll.—Frequent in all our streams, and in the fossil state at Copford in great plenty.

V. CRISTATA, Müll.—I find this species is more frequently an inhabitant of ponds than *V. piscinalis*. It occurs everywhere throughout the district, and is one of the shells chosen frequently by a Caddis-worm to form its case.

LIMNÆIDÆ.

PLANORBIS LINEATUS, Walker.—I have seen shells said to have been found in the Stour within my boundaries, but have never taken the species myself.

P. NITIDUS, Müll.—Occurs in many parts of the district both in slow streams and ponds, but it is not frequent.

P. NAUTILEUS, Linn.—No doubt is frequently passed over from its small size. I find it sometimes very abundantly in ponds at West Bergholt. Var. *cristata* occurs in the same spots, and is, I think, one of our most beautiful shells.

P. ALBUS, Müll.—Abundant where it occurs, but occasionally for years it seems almost to die out in some ponds. It is found on all soils: also in brackish water on the marshes near Wyvenhoe Park.

P. SPIRORBIS, Müll.—Very abundant. I have found several distorted specimens in which the whorls are more or less separated or displaced.

P. VORTEX, Linn.—Not quite so abundant as the last species, but found all over the district.

Var. *compressa*.—Occasionally in the marshes of the Colne.

P. CARINATUS, Müll.—I find this snail more frequently in the marshes by the rivers and brooks than in stagnant ponds. It is said never to be plentiful, but I once found a shallow pond near Ardleigh Crown swarming with it.

P. COMPLANATUS, Linn.—Common throughout the district.

P. CORNEUS, Linn.—I never find this mollusk in ponds unless they are in the marshes and connected with the rivers; there they are fairly plentiful. The largest specimens I have seen were reared in a soft-water butt, at Wormingford.

P. CONTORTUS, Linn.—Common in our rivers and ponds of stagnant water in many parts of the district.

PHYSA HYPNORUM, Linn.—Very local and rare. An occasional

one may be found in the Colne. In a ditch running into this river near Sheep-pen Bridge at times it is very plentiful; but often for months this ditch is dried up, and then I do not know where to find the snails.

P. FONTINALIS, Linn.—Frequent in all the brooks and streams.

LIMNÆA PEREGRA, Müll.—Everywhere.

Var. *ovata*.—I have never found this form except in the Colne and Stour. Some specimens are very large and not unlike *L. auricularia*.

Var. *acuminata*.—I find this also in the same localities as the last.

Var. *maritima*.—Occurs in considerable numbers in the brackish, almost salt, water of the ditches near Wyvenhoe Park, in company with *P. albus*.

Var. *scalariformis*.—Frequent in the small drains of one meadow near Birch Hall. There are all the intermediate stages between the normal forms and those in which the whorls of the shell are nearly separated.

L. AURICULARIA, Linn.—In the Stour and also in the Colne, but the intermediate forms between *L. peregra* and this species make it at times difficult to decide to which the varieties belong.

L. STAGNALIS, Linn.—Frequent in the Stour, and especially so in some years; also in ponds in many parts of the district where clay occurs. I never find it on gravel. In some ponds at Wormingford the shells are quite two inches long.

L. PALUSTRIS, Müll.—Frequent in ponds on all soils.

L. TRUNCATULA, Müll.—Common everywhere. It is difficult to understand how this snail exists in shallow roadside puddles which are dry during months in the year. These situations generally produce :—

Var. *minor*.—Commonly.

Var. *major*.—I have found this form in a pond near Bottle End, Stanway, which is never dry, in company with *L. palustris*.

L. GLABRA, Müll.—Ditches and shallow ponds, abundantly; especially on gravelly soils. I once found it in a wet spot in

Donyland Wood, where the spring scarcely gave enough water to cover the shell. This is one of the molluscs which æstivates early, very frequently disappearing early in March.

Ancylus fluviatilis, Müll.—I have only found this mollusc in the stream near Kingsford, Stanway, and there sparingly, adhering to stones.

A. lacustris, Linn.—Frequent in the Stour and Colne on water-lilies and other plants. The dead shells are very numerous in the Stour at Wormingford, and are also plentiful at Copford in the classic Shell Marl.

Limacidæ.

Arion ater, Linn.—Common everywhere.

A. hortensis, Linn.—Common everywhere.

Limax flavus, Linn.—Common everywhere.

L. agrestis, Linn.—A common pest.

L. maximus, Linn.—Frequent in ashpits in the town, as well as commonly in woods and damp places.

Helicidæ.

Succinea putris, Linn.—Frequent in wet spots by the rivers and brooks. In the water-furrows of the meadows near New Bridge, I find a very small variety, with a shell, in proportion to its size, thicker than usual; this may be Var. *subglobosa*, Jeffreys. It has one peculiar habit, being rarely found otherwise than submerged. In the spots where I find this variety, I never find the normal form.

S. elegans, Risso.—Common on duckweed in the ditches of the meadows close to the town; its blackness makes it very prominent.

Vitrina pellucida, Müll.—Frequent under stones, wood, or anything which retains moisture, the dead shells being much more numerous than living ones.

Zonites cellarius, Müll.—Frequent in suitable spots. I have found it in damp places at the foot of the cliffs at Walton-on-the-Naze, of a dark horn colour; but in some cellars at Shrub End, near Colchester, the shells are very large, flat, and almost white in colour.

Z. ALLIARIUS, Miller.—Very common under fallen timber in woods.

Z. GLABRA, Studer (*Z. alliarius*, Miller).—In similar spots to the last species. Not rare.

Z. NITIDULUS, Drap.—Everywhere in moss, damp herbage and dead leaves. I also find it commonly in the loose soil under leaves in woods.

Z. PURUS, Ald.—The like localities produce also this species, but not so commonly as the last, and I never find the shells so nearly white as some I have had sent me.

Z. RADIATULUS, Ald.—I find this species and other small shells by sifting the leaves and rubbish from the damp places of our woods, in a brisk current of wind. By repeating the process again and again, I have at last but a small quantity of rubbish to spread on white paper and search over, and I find this species to be not nearly so rare as is generally supposed.

Z. NITIDUS, Müll.—Rare, but easily distinguished by the dark colour of the snail when living. Found occasionally under moss and damp herbage.

Z. CRYSTALLINUS, Müll.—Frequent in wet moss and under dead leaves in all suitable places. Found by searching and winnowing as above described.

Z. FULVUS, Müll.—Very common under leaves in woods.

Suitable damp spots seem equally productive of this genus in this district, whether the soil be clay, gravel or sand. I have not therefore stated the soil on which I have found individual species.

HELIX ACULEATA, Müll.—Very rare. I did not think it occurred until I adopted the winnowing process.

H. ASPERSA, Müll.—Extremely abundant everywhere. I cannot recognize any of Jeffreys' varieties, but in Trinity Churchyard, opposite my house in the centre of this town, we often find an albino aberration.

H. NEMORALIS, Linn., and H. HORTENSIS, Müll.—Both very common, and as they are usually considered to be simply varieties I give them together, but I generally find where one is abundant the other is scarce, and I very much question whether they are not distinct species.

H. ARBUSTORUM, Linn.—Not rare, but very local.

H. CANTIANA, Mont.—Very common, especially on the gravel.

H. CONCINNA, Jeffr.—Abundant on the Roman wall and elsewhere, in suitable spots throughout the district.

H. HISPIDA, Linn.—Common.

H. VIRGATA, Da Costa.—Abundant on the coast at Walton and Clacton, on the cliffs of London Clay. Found also inland, on gravel and sandy soils, but local. At Paglesham near Rochford, on clay, (but this is beyond my district), I have seen the vegetation absolutely swarming with this species and *H. caperata*. It is there very large, and many of these large shells have scarcely any markings.

H. CAPERATA, Mont.—Common, but local.

H. ERICETORUM, Müll.—I have never found this species except by the side of the brook at Marks Tey, where the subsoil is boulder clay.

H. ROTUNDATA, Müll.—Abundant in woods under fallen timber, bark, leaves, &c.

Var. *alba*.—Rare.

H. PULCHELLA, Müll.—Not rare in damp spots in pasture in all parts of the district.

Var. *costata*.—I find this form on the Roman wall surrounding the town.

H. LAPICIDA, Linn.—I have no doubt this snail occurs in the district, as I once found a dead shell at Layer de la Hay, and I know it occurs at Wiston, on the Suffolk side of the Stour, on a sandy subsoil.

BULIMUS OBSCURUS, Müll.—Rare. I find an occasional shell in the hedges.

PUPA UMBILICATA, Drap.—Frequent on the Roman wall and on Colchester Castle, and very rarely on trees.

P. MARGINATA, Drap.—About as common as the last on the castle and wall; rare elsewhere according to my experience, but the Rev. Revett Sheppard says it occurs in profusion near Wrabness Point, in the Stour estuary, a situation which at high tides is covered with water.

The above two forms are the only species of the genus *Pupa* that I have been able to find or hear of as occurring in

the district, and no species of *Vertigo* has been recorded. Some species exist in all probability, but none of my friends who have searched for shells have found them, nor have I been more fortunate, although in other parts of the country I have experienced no difficulty in detecting *Vertigos* when inhabiting the locality.

Balia perversa, Linn.—I found this snail once, commonly, under the bark of a dead poplar, near the Decoy, West Mersea, and this is the only situation in which I know of its occurrence.

Clausilia rugosa, Drap.—Locally abundant, and occurring in many parts of my district sparingly. I think they are most frequent on the Boulder Clay formation. I have not recognized any of the named varieties.

Cochlicopa tridens, Pult.—I have no doubt this occurs, although I have never found it. It occurs sparingly at Wiston, on the Suffolk side of the Stour.

C. lubrica, Müll.—Frequent in all parts of the district, but I have not been able to distinguish any of the named varieties.

Achatina acicula, Müll.—I have never met with the living snail, but dead shells are found in all parts of the district. It is said to occur only on calcareous soils, but I find the shells most frequently in the sandy and gravelly soil around the town. In the rubbish and growing sods of grass on the Roman wall it is frequently noticed, and some years since a Roman cloaca near the castle was opened, and in the soil at the bottom of the drain this shell occurred in thousands. There is one way to find it that I have never seen mentioned. It is to search the tops of the hills of the small ants in the open fields, on any soil, and amongst the earth the insects bring up the shells may generally be found, frequently washed clean by the rain which has percolated the soil.

Carychiidæ.

Carychium minimum, Müll.—Common everywhere in damp spots in meadows, hedges and woods. Easily found by employing the winnowing process.

The above list is as complete as I have been able to make it. Of course there are portions of the district that I have not explored, as my engagements have prevented me making long excursions; but as far as I have gone I think I have searched over the ground somewhat minutely and carefully. It will no doubt be remarked that there is almost an entire absence of species of the genera *Pupa*, *Vertigo*, and *Clausilia* in my catalogue. I suppose this fact may be accounted for by the deficiency of calcareous strata in the district. All the names of shells which appear in the list are inserted after a personal examination of the specimens and localities, and may be relied upon. I have carefully verified every shell named, and to insure correctness in doubtful cases I have had my opinion confirmed by some of the best authorities.

I cannot leave this subject without calling attention to an extraordinary deposit of land and fresh-water shells, in a fossil condition, in the brickyards at Copford. This Shell Marl was fully described by the late John Brown, F.G.S., in the 'Journal of the Geological Society of London' for August 1852, vol. viii., p. 184. He shows that more than sixty-nine species are there represented, only two of which (*Helix incarnata* and *H. ruderata*) are extinct in this country.

From a personal examination I can testify to the number of *Vertigos*, both as regards species and individuals, as well as other rare shells, contained in this deposit.

XIII. The Galls of Essex; A Contribution to a List of the Insect Fauna of the County.

By Edward A. Fitch, F.L.S., Sec. Ent. Soc., &c.,
Vice-President.

[Read October 29th, 1881.]

A gall may be defined as an abnormal or morbid growth, due to parenchymatous hypertrophy, and produced by the peculiar action of some unnatural or foreign agency, probably through mechanical irritation. These growths occur both in the animal and vegetable kingdoms. Animal galls are not common, unless we include the various inflammatory growths and excessive developments of cuticle so common in the Mammalia, which are gall-like in nature, although not true galls. Animal galls caused by insects, however, occur in the peculiar "worbles" or "bots" often so commonly seen on the backs of our young cattle; these are produced by a dipterous fly (*Œstrus bovis*, Linn.), which lays its eggs under the skin of the bullock, and the inflammation set up produces a gall in which the larva resides until full-fed.[1] This is hardly a true gall, as there is a small orifice communicating with the open air, but still it is as analogous as the exigencies of animal and vegetable pathology will allow. Animal pseudo-galls have also been produced by the action of various Acaridea. Much of interest might be said about these and other pseudo-galls; but our business is with the vegetable galls more particularly, and to these we will turn.

Plant galls are fairly ubiquitous, and some kinds must be known at least by sight to everyone; these distinct abnormal growths have been noticed by all naturalists or general observers in one form or another, especially the galls occurring on various trees, as the oak, willow, elm, or rose.

[1] Many similar swellings are produced on various animals by the Œstridæ. *Cf.* F. Brauer's 'Monographie der Œstriden.' Vienna, 1863.

Galls are known to occur on plants in nearly every order of the vegetable kingdom; they vary greatly in their form and in their situation on the plant. This will be fully exemplified presently, when I shall come to a detailed examination of our Essex gall fauna.

More strictly speaking, the term "gall" is applied to an abnormal vegetable growth. Lacaze Duthiers defines "galls" as comprising "all abnormal vegetable productions developed on plants by the action of animals, more particularly by insects, whatever may be their form, size, or situation."[2] This is by no means a scientific definition, but the limitation is convenient and the intention is apparent. It must, however, be remembered that all abnormal vegetable growths are not galls, as will readily be seen from a study of Dr. Masters's 'Vegetable Teratology.'[3]

This brings us to a starting point—the cause of galls. A gall is an abnormal vegetable growth produced through the internal action of some foreign agency. This agency is generally either the influence of a fungus or of some Arthropod. Certain of the Anguillulidæ,[4] belonging to the Nematode worms, and some Infusoria (*Vibrio*, &c.), are also gall-makers, and possibly even certain Rotifera. Both the animal and the vegetable causative actions produce often remarkably similar inflammatory and stimulated growths, and most frequently these are abundantly distinct from any normal production or growth of the galled object.

So far the subject is clear, but the exact way in which the foreign influence is brought to bear on the vegetable growth is still matter for conjecture and experiment. The actual progressive structure of the gall itself also still affords a good working field for the structural botanist.

The "gallic" force of an insect, so to speak, is vulgarly

[2] 'Annales des Sciences naturelles.' Botanique. 3rd series, vol. xix., p. 273. Paris, 1853.

[3] 'Vegetable Teratology.' By Maxwell T. Masters, M.D., F.L.S. London (Ray Society), 1869.

[4] 'Monograph on the Anguillulidæ.' By H. Charlton Bastian, M.A., M.B. Transactions of the Linnean Society, vol. xxv., pp. 73—184, pls. 9—13. (1866).

supposed to consist of some acid injection into the plant-tissues, at the time of oviposition, by the parent insect. It may well be thought that the Cynipidæ sting plants in a way similar to that in which the Aculeate Hymenoptera (ants, bees, wasps, &c.) operate upon animals, and which is so often painfully patent to ourselves; even the gall-gnats (Cecidomyidæ) may be similarly accredited with a kind of stinging power without much stretch of imagination, when reasoning from analogies. But we can hardly suppose many of these growths to be due to the stings of the various moths, beetles, plant-lice (Aphides), bugs, and especially mites, which are known to produce them. Scientifically also, the theory of a special "gallic" poison injected by the mother gall-maker cannot stand. I am sorry to see that Sir James Paget should foster this opinion, when he remarks:—"We find hundreds of different forms of galls, and we may be nearly sure that there are as many kinds of morbid poisons produced by the gall-insects, each form answering to a different virus."[5] Mr. G. B. Buckton also writes, "It may be noted that the injection of acrid or other juices into living vegetable tissue by Hemiptera and other insects produces on plants phenonema very similar to inflammation in animal organisms. Vessels become turgid, cell-walls become thickened, and abnormal growths (in vegetables often elegant instead of monstrous) take the place of simple structures."[6]

In a paper read before the Linnean Society on January 21st, 1875, Dr. W. Ainslie Hollis fully examined the question of the causative formation of galls. To this memoir I am indebted for some of the following views and opinions of the older writers.

Zoology and Botany as sciences may reasonably be said to commence with Linné. It will be quite useless to examine further back, although folk-lore is very entertaining and the

[5] 'An Address on Elemental Pathology, delivered in the Pathological Section of the British Medical Association, at the annual meeting in Cambridge, August, 1880.' By Sir James Paget. P. 23. London, 1880. Also the 'Lancet,' October 23rd, 1880, p. 646.

[6] 'Monograph of the British Aphides.' By George Bowdler Buckton, F.R.S., F.L.S., &c. London (Ray Society), vol. iii., p. 85; 1881.

folk-lore of galls would yield a goodly chapter, but with little help towards the present enquiry.[7] Compare the well-known remarks of many classical writers, and some curious information given in Kirby and Spence's 'Introduction to Entomology.'

Linné tells us the insect punctures the plant, and the outflow of sap from the wound is the cause of the formation of the gall. "Cynipes succo plantarum e vulnere inflicto stillante et in gallam in qua habitant larvæ excrescente victitant." [Gmelin's Linné, 'Syst. Nat.,' vol. i., pars. v., p. 2650.]. De Geer, Réaumur, Roesel, Frisch, Malpighi, and others had previously promulgated this convenient but thoroughly untenable theory; still this was generally accepted to the days of our own Kirby and Spence.

These fathers of British Entomology epitomized the information on this puzzling subject thus:[8]—"How the mere insertion of an egg into the substance of a leaf or twig, even if accompanied, as some imagine, by a peculiar fluid, should cause the growth of such singular protuberances around it, philosophers are as little able to explain as why the insertion of a particle of variolous matter into a child's arm should cover it with pustules of small-pox. In both cases the effects seem to proceed from some action of the foreign substance upon the secreting vessels of the animal or vegetable; but of the nature of this action we know nothing. This much is ascertained by the observations of Réaumur and Malpighi—that the production of the gall, which, however large, attains its full size in a day or two, is caused by the egg or some accompanying fluid,—not by the larva, which does not appear until the gall is fully formed; that the galls which spring from *leaves* almost constantly take their origin from nerves; and that the egg, at the same time that it causes the growth of the gall, itself derives nourishment from the substance

[7] References to fossil galls and some antiquated information occur in Mr. Albert Muller's memoir, 'In Memoriam Wilson Armistead, of Virginia House, Leeds.' 'Zoologist,' 2nd ser., vol. iii., pp. 1196—1208; May, 1868.

[8] 'An Introduction to Entomology.' By William Kirby and William Spence. 4th ed. (1822), vol. i., p. 450; 5th ed. (1828), vol. i., p. 448.

that surrounds it, becoming considerably larger before it is hatched than it was when first deposited. When chemically analysed, galls are found to contain only the same principles as the plant from which they spring, but in a more concentrated state."

Hartig, in his specially scientific memoirs on the cynipideous gall-makers, treats somewhat lengthily on the physiology of the gall insects themselves, but on the growth of their productions he says but little, limiting himself strictly to the facts observed. He merely states, "The gall-flies are divisible into three groups, according to their mode of life. To the first of these belong those species which live some on the plant-juices and some on the cellular tissue and cork (starchy portions). These alone produce, through their oviposition in certain plants and parts of plants, an hypertrophy of the part from the usual form, and shape the plant-substance into a larva-house, the inner structure and outer form of which is dependent on the producing species of gall-fly. Every true gall-producing gall-fly has its own special form of gall, which is constant within certain limits; and we never find two similar species of true gall-fly inhabiting different formed galls, nor do we breed from similarly formed galls different species of gall-flies of the first group, which I therefore call Psenides."[9]

To come to the more feasible theory, as expounded by Dr. Hollis, we find that Van der Hoeven started on what may be considered the right road, when, after speaking of the deposition of the egg by the female Cynips, he says, "The irritation thus produced causes the sap to flow in greater abundance to the wounded part."[10] Dr. Johnston, of Berwick, marked a still clearer line when he tells us, "We observe that the irritation caused by the deposition and evolution of the egg will produce growth of the most curious kind, and differences in the irritation, too slight to be traced, will occasion very remarkable differences in the appearance of

[9] Translated from Germar's 'Zeitschrift für die Entomologie,' vol. iii. p. 322. Leipzig, 1841.

[10] 'Handbook of Zoology,' translated by Clark, 1856, i. 384.

the growth."[11] Hofmeister observed the same principle when he maintained that the growth of the gall is due to the fact that it encloses an active living grub;[12] but he has overlooked those very obvious circumstances in which we find the galls fairly formed and often well grown before the larva-state of their legitimate inhabitants is reached. Here we fall back on Hartig, who had already clearly demonstrated the absolute growth of the curious pedunculate eggs of the Cynipidæ and other terebrant Hymenoptera.[13] Dr. Hollis gave a quotation from Guibourt, which I here include,[14] relative to the commensalism between the active life of the gall and of the gall-maker; and then continues, "With some reservation I accept the theories of Hofmeister and Guibourt, with regard to the origin and growth of the gall-nut, but I must introduce a third element into their formation, which appears to have been somewhat overlooked by these writers, and that is, the active growth of the plant itself."[15] This all-important element had probably been understood, still it needs enunciation. It is most certainly a fact that a gall is never produced, except on those parts of a plant which are in active growth and in full receipt of the sap-flow. It may also, I think, be taken as a fact that the more active the

[11] 'Flora of Berwick-upon-Tweed,' ii. 108.

[12] 'Die Lehre von der Pflanzenzelle,' p. 634. (Leipzig, 1867).

[13] 'Wiegmann's 'Archiv für Naturgeschichte,' iii., p. 151, pl. iv., 1837. Germar's 'Zeitschrift für die Entomologie,' ii., p. 179 (1840), and iii., p. 327, pl. i., figs. 5, 6 (1841). Also consult 'Over de Legboor van Aphilothrix radicis, Fabr." By Dr. M. W. Beijerinck, in the 'Tijdschrift voor Entomologie,' vol. xx., pp. 186—198, plates 11 and 12; 1876—7.

[14] "Une autre observation qui est commune aux autres galles, c'est que tant que l'insect y est enfermé, la galle du chêne tauzin offre une couleur rougeâtre et verdâtre, et une surface luisante qui indiquent qu'elle participe à la vie de l'animal; tandis qu'après sa sortie, elle prend une couleur terne et grisâtre et semble mourir." 'Histoire naturelle des Drogues simples,' 1849; ii., 278.

[15] In a note on insect gall buds, Mr. A. Stephen Wilson, of Aberdeen, under date May 15th, 1879, thus writes to 'Nature' (vol. xx., p. 55):— "The insertion of the ovipositor brings a medullary ray into action, producing a tuberculated bud, and it is only the bud which the larva feeds upon. The growth of a bud is an intelligible cause of the growth of a gall, but we can infer nothing from the injection of a fluid."

growth of the normal organ affected by the gall the more short-lived the abnormal formation. In other words, the most quickly matured species of galls are always on the short-lived organs of reproduction rather than on the slow-growing organs of vegetation. For instance, in the oak, compare the catkin galls with the root and stem galls—the growth of *Spathegaster baccarum* galls with those of *Aphilothrix Sieboldi*, for instance. In the galls of *S. baccarum* I have also noticed that the growth is quicker in the catkin form than in the leaf form; the spring bud galls (e.g., *Spathegaster aprilinus*, *Aphilothrix albopunctata*, &c.) grow and mature much faster than the autumn galls (*Aphilothrix globuli*, *Andricus gemmæ*, &c.).

In the galls of the Cynipidæ we thus know that, soon after the deposition of the egg, active animal growth commences; this immediately sets up irritation of the plant-tissues, and according to the subtle specific character of the irritation and the nature of the part of the plant acted upon, the particular morbid or hypertrophied growth is produced and is maintained by an increased influx of nutritive material. This growth, however, only continues during the active life of the tenant; for as soon as the irritation ceases, apparently the vegetal growth also stops. This is quite analogous to the action of certain special irritants and the diagnoses of certain inflammatory actions in causing œdematous swellings in animal organisms, the different effects and nature of each being well known; as with the multifarious forms of galls the cause and effect are patent, but the subtle differences occasioning such constant but diversified results are untraceable. In the animal kingdom, hypertrophy or thickening of the cuticle is known to occur as the result of continued pressure to any part; but a less pronounced form of hypertrophy of cuticle is seen in the various forms of warts, where pressure is not an immediate agency in their production. I believe no intelligible explanation of the cause of warts and similar excrescences in the animal kingdom can be given; it is so with the vegetable galls, but in this kingdom we well know that the growth of the cambium tissue, &c., is accelerated

before the removal of pressure, as in the case of plant-cuttings, the growth of trees, &c. Gall-growth may be similarly affected by the removal of pressure through the puncture made by certain gall-producers, and in obvious other ways.

Sir James Paget has recently followed up Dr. Hollis's suggestions in enunciating the importance of the comparative pathology of oak-galls, in the remarkable address before quoted. I cannot forbear giving his valuable remarks relative to gall pathology *in extenso*, with the hope that some of our members may be led to take up this interesting study, which so closely affects both animal and vegetable physiologists. These were his words:—

"Of all morbid processes in plants, none, I think, are so suggestive as are those produced by parasites, whether vegetable or animal. The whole subject would be far too large to speak of, even if I were familiar with it; it is, indeed, a subject of the gravest national importance; but, keeping to the design with which I started, and which was only that of pointing out where useful pathological knowledge may be gained, I will speak of only some of the changes which are produced by insects. The most remarkable of these are the galls; and, among the many hundreds of them that have been described, I may assume that you know some in their natural mode of growth—such as the common oak-apple, with which some celebrate the restoration of our monarchy; and the bedeguar of the wild rose; the bright crimson oak-spangle, the currant-gall, or the artichoke-gall, or the gall of pharmacy. But, besides the hundreds of different true galls, there are still more hundreds of changes of structure in leaves and stems and roots, all produced by the irritant secretions of insects, and all such as may justly be ascribed to processes of inflammation. In some, as in the 'curl' of the leaves of the whitethorn, you find thickenings of leaves which are lifted, rolled, or curled into chambers, which serve for defence of the Aphides or other insects; in some, the thickened and distorted clusters of leaves, in buds or on twigs, roll up and are mutually fastened, so as to form the walls of similar defensive lodgings; in some cases, leaves become swollen as with a kind of œdema; in some, their layers separate as if with blistering; or leaves, or stems, or fruits, or clusters of flowers, buds, or roots, produce variously

shaped and variously constructed growths of cellular parenchymatous tissue and cork, and, more sparingly, of woody tissue or of cells whose thick walls become as hard as wood. Besides, some of the monstrous growths of parts of plants, and some of the viviparous variations, and of the undue metamorphoses of leaves, are to be referred to the influence of parasites.

"It may seem bold to speak of so many hundreds of widely various morbid processes as having any essential character in common, or as fit to be included under one name; yet I think we may regard the whole of these as being such as, in our pathology, we should call inflammatory hypertrophies or hyperplasiæ. They all show a rapid increase of lowly organised structures, by derivation from, and in continuity with, those pre-existing. There is, as in the products of our inflammations, a general likeness among these new structures, whatever be the part of the plant from which they are derived, and all bear a general likeness to the structures formed after injuries of actively growing parts. In the morbid growths formed by these new structures, the deflection from the natural shape and construction of the part, in continuity with which they have grown, is often not complete; they often retain marks of characteristic normal forms, and sometimes acquire marks of natural variation from the species. Moreover, all these morbid growths have their origin in what may justly be called 'irritation' of the part on which they grow; and in all of them, I think, we may note signs of degeneracy from natural conditions, either in the absence of stomata or similar structures, or in the presence of the red, or yellow, or other colours commonly noticed in decay.

"Here, I believe, are reasons enough for regarding all these galls and gall-like products of disease, generated in plants by insects, as analogous with a large group of the products of inflammation which we study in our own pathology; and the analogy is not the less because neither group can be circumscribed with any exact definition.

"I will not be tempted to speak long, but I beg you to think long, of the marvellous facts of natural adjustment which we have here, in this intense example of the '*sic vos, non vobis.*' Here are the bare facts. Each species of these parasitic insects can compel some part of a plant into such disease as shall supply good food, or well-built and well-placed lodging, or both, for itself or for its eggs and larvæ, or even for part of the life of its complete offspring. Each

insect selects, by instinct, the very part of the plant which is adapted to its purpose. The provision made at the cost of the plant is exactly adapted in quality to the welfare of the insect or its offspring, and in quantity as well; for both the lodging and the food are made sufficient for any necessary time—for days or weeks, often for many months; in some instances for two or even three years. Nay, more than this, a gall, of which the growth has been provoked by the virus of one insect, may be fit for the food and lodging of another, which, when all seems complete, can penetrate the gall-cavity, and there, as with theft or murder, obtain food and lodging perfectly suited to itself or its progeny. And the whole process in the plant, though it be one of disease, and, in a sense, unnatural, is yet so regular, so constant and specific, that the form and other characters of each gall or other morbid product are usually as constant and characteristic as are those of the insect itself, and the differences among the galls are at least as great as those among the insects. Is there, in all the range of natural history, a more marvellous group of facts than may here be studied? If you would like to work out a problem in evolution, find how it has come to be a part of the ordinary economy of nature that a gall-insect compels some part of a plant to grow in a manner which, while injurious to the plant, becomes useful to one insect not yet born, and to another who will in due time invade the gall and kill and feed upon its occupant, and then may itself be invaded and eaten by a third.

"But now of the relation between galls and our specific diseases, such as our eruptive fevers, syphilis, cancer, gout, and others.

"In these galls and other similar diseases in plants we have, it seems, hundreds of specific diseases due to as many hundreds of specific morbid poisons; for the most reasonable, if not the only reasonable, theory of these diseases is, that each insect infects or inoculates the leaf or other structure of the chosen plant with a poison peculiar to itself. The poison may be merely deposited; but, in the instances best for study, it is inserted in the plant-structure, whether leaf or any other; and the wound for inserting it, the poisoned wound, may be made either with part of the oral apparatus, or, as in most of the true galls, with the ovipositor through which one or more eggs are passed with the virus, and are left among actively living structures of the plant. The little wound closes; the virus, whether an oral or an ovarian secretion, remains; and the result of its influence on the plant-

structures and their contained protoplasm is the formation of the gall or other morbid product. The whole process may be compared with the local consequences of the insertion of vaccine lymph, or any such morbid poison, in ourselves or other animals. I say the local consequences, for we have no clear evidence of what might be called general infection or constitutional disease in the gall-forming plants. In the absence of quickly moving fluid, such as lymph or blood, the virus infects only the part in and very near to which it is inserted. A single oak-leaf may have fifty 'spangle' galls on its under-surface, but the structures between them may be quite healthy; and when in any instance a general damage is done to a plant by gall-growths, it seems to be only as a remote consequence of the spoiling of considerable portions of its structures. And this appears to be true, even though the virus may continue active for a long time, as in the galls which begin to grow soon after the insertion of the virus with the ovum, and continue to increase during the whole—sometimes long—development of the larvæ; or even, in a few instances, after the larvæ have deserted them.

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"We find hundreds of different forms of galls, and we may be nearly sure that there are as many kinds of morbid poisons produced by the gall-insects, each form answering to a different virus. This may suggest that we may be too grudging in thinking of the number of morbid poisons, or of their modifications in the blood, to which diseases in ourselves may, at least in part, be due.

"It is true that the galls are produced by many species of insects on many species of plants; and that the differences among these species may be as wide as those between ourselves and any other Mammalia. But, even among closely allied species, there are many and very different forms of galls. Mayr, ten years ago, described and figured ninety-six kinds of galls found on the oaks of Central Europe, all but two of them being produced by different species of gall-wasps. Of those ninety-six kinds, thirty-two are formed on the leaves alone; and even on similar parts of one oak-leaf it is not rare to find three or four different forms of galls.

"We have, thus, clear evidence of a very large number of morbid poisons, each of which is capable of producing, in an appropriate subject, a distinct specific disease with a characteristic morbid structure.

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"It may be observed, however, that these great differences are marked in outer shape and construction much more than in minute structure. As, in human pathology, there are certain general characters and degrees of likeness in all inflammatory products, however differently they may be constructed—in pustules, vesicles, thickenings, opacities, adhesions, scars, fibroid and other changes; so, in galls, there are certain likenesses in minute structures, even among those that are, in their construction, size, and outer shape, most unlike.

"It may be well to learn from this a lesson on the imperfection of our methods of minute research. As we cannot doubt that the differences in outer shape and method of construction of the products of specific diseases are associated with differences of chemical composition and ultimately minute structure, so it must be in those yet greater differences on which we frame our distinctions of species in all living nature. The coarse, visible, and tangible distinctions may be well marked; the really material differences with which these are associated, and to which probably they are due, are beyond our reach.

"Again, in the study of specific diseases in ourselves, we see many variations due to the differences in the parts, or even in the persons affected with them. In the study of galls, similar variations may be seen. As a general rule, each gall-insect lays its eggs in one part of one plant—as the leaf, leaf-stalk, bud, fruit, or root of this or that species; but if—as rarely happens—one lays in different parts of the same plant, there is usually a very close agreement in the characters of the resultant galls. A few exceptions to this rule are known, one of them being in the very different galls produced on the roots and on the leaves of vines by *Phylloxera vastatrix;* but the rule is generally observed, and accords with the fact of certain features of general likeness being observed in the products of our several specific diseases, wherever they may be seated.

"When the same insect lays in similar parts of different plants, the galls may be all similar; but I believe that they more usually are different, and that their differences are such as bring them severally nearer to the distinctive characters of the plants on which they grow; just as, in ourselves, a specific disease may be modified by the personal conditions of each patient.

"In similar analogy, the differences are yet greater when the eggs are laid in different parts of different plants.

"Very rarely, the same insect may produce on one leaf different forms of galls.

"In all these points you may, I think, find help in the study of specific diseases. I will add only one more. Usually, the gall begins to grow directly after the deposit of the egg; but sometimes there is a long delay, a long period of suspense, an "Eiruhe," which may last for many months before the growth begins. What is going on during this time? I believe we may see here an instance of events very difficult to study in our own pathology, in which two or more conditions must concur to the production of some disease, and one of them must wait for the complete efficiency of the rest. In the case of these long-delayed galls, either the egg, after being laid, requires a long time for the completion of changes ending in the production of the necessary morbid poison, or the plant-structure in which it is laid requires the time for changes to make it susceptible of the poison; or both egg and plant may need to change. So, in us, two or more conditions must concur. A tendency to gout may be inherited, and the blood may have slowly acquired the necessary morbid condition; but no structure may be susceptible of gouty disease till a blow, or a strain, or some disturbance of nervous force makes it so. So with cancer; a general tendency may be inherited, but it must wait till the material of some structure is, by age, or injury, or long-continued 'irritation,' changed into fitness for concurrence in morbid action with the material on which the general tendency depends. * * * * In the growth of these galls, the comparison may seem less far-fetched. At least, it may be difficult to suggest any nearer comparison for a process in which the meeting of two living materials from different organisms is immediately followed by such a change in the method of life of one of them, as ends in the production of a definite new growth exactly adapted to the method and purpose of the life of the other.

"But it is more than time that I should have done with galls. If I have been tedious, let me assure you that I am myself ashamed to have gathered so little from the rapidly increasing records concerning them to which the botanists, and still more the entomologists, of our time are contributing. And, even for that little, I feel as if I deserved to be compared with one of those burglars of whom I spoke as feeding on the results of other's labours. Let it be my apology, that I believe I have taken nothing that those others would have used. I have only taken from their rich stores of facts some that may be much more useful in pathology than

in natural history. And I am sure, from all I know of naturalists, that they will gladly let any of you into their fields, though you may use them for your own purposes much more than for theirs. It would be difficult to find a field for the study of the very principles of pathology larger or richer than this offers to you. The objects are within easy reach; hundreds of morbid processes are at hand for deliberate study; experiments may be made at will; during many months, thousands of insects, as natural vivisectors, will be at work for you, and it must yet be some years before they will be required to take out licences." [*Op. cit.*, pp. 20—28].

With these pregnant suggestions, I now leave the origin and growth of galls, and pass on to the insects which produce them; but once again expressing the opinion that mechanical irritation rather than the action of a specific virus is the probable explanation of gall-growth.

The vegetable-structure of the various galls deserves a separate memoir, and I leave this in the hands of some of our botanical members, contenting myself with referring them to the following important articles by Meyen,[16] Lacaze-Duthiers,[17] Prillieux,[18] Beijerinck,[19] Courchet,[20] and Frank.[21]

[16] Meyen, 'Pflanzen-pathologie' (1841), divided into:—'Auschwellungen,' Odemata, pp. 63—65; 'Blasenformige Auftreibungen,' Emphymata, pp. 65—66; 'Fleischgewächse,' Sarcomata, pp. 66—68; 'Galläpfel,' Gallæ (on oaks chiefly), pp. 68—71. There is also a French version, 'Traité de Pathologie Végétale.' I have not been able to find the works either in the libraries at British Museum, Kew, or the Linnean Society.

[17] 'Recherches pour servir à l'histoire des Galles,' par M. Lacaze-Duthiers. 'Annales des Sciences naturelles,' Botanique, 3rd Series, vol. xix., pp. 273—354; pl. 16—19 (Paris, 1853).

[18] 'Études sur la formation et le développement de quelques Galles,' par M. Ed. Prillieux. 'Annales des Sciences naturelles,' Botanique, 6th Series, vol. iii., pp. 113—137; pl. 16—18 (Paris, 1876).

[19] 'Bijdrage tot de Morphologie der Plantengallen.' By M. W. Beijerinck. 92 pp. and 2 plates (Utrecht, 1877).

[20] 'Étude sur les Galles causées par des Aphidiens,' par M. L. Courchet. 'Académie des Sciences et Lettres de Montpellier; Mémoires de la section des Sciences,' vol. x., pp. 1—102; pl. i.—vi. (Montpellier, 1881).

[21] Frank's 'Die Krankheiten der Pflanzen.' Breslau, 1881. For galls, see pp. 661—798.

Réaumur's 12th Memoir[22] might be consulted with advantage, and Malpighi[23] should also be referred to.

The natural history and affinities of the gall-producers come more within the field of my own entomological studies; but before entering upon that branch of my subject, I should like to call attention to the "individuality," so to speak, of a gall. Dr. Mayr has already recorded the fact (and I have myself frequently noticed the same thing) that when such galls as those of *Aphilothrix radicis*, *Andricus terminalis*, or *Dryophanta folii* are detached from their root, bud, or leaf, and supplied with moisture, or kept on damp earth or sand, they grow considerably. This is probably owing to the swelling of their cells and the attenuation of the cell-walls. The oak spangle galls (*Neuroteri*) nearly double in size, and almost the whole growth of the inner larva-cell takes place when the gall is on the ground, after its fall from the leaf; this must greatly alter or modify the individual cellular structure.

Two animal sub-kingdoms include species which are vegetable gall makers, although these structures are mostly the work of insects. Two or three species of Anguillulidæ are known as gall-producers; these belong to the Annuloida. Among the Arthropoda nearly all the species of the somewhat abnormal but large genus *Phytoptus*, belonging to the Acaridea (or Mites), are gall-makers, and many of them produce some of our commonest plant-deformities (*e. g.*, on the birch, lime, maple, sycamore, alder, sallow, blackthorn, &c.).[24] For some time these were believed to be but true vegetable growths, and were described as Fungi. Of the nine orders belonging to the class Insecta, few contain gall-makers—Collembola, Thysanura, Orthoptera, and Neuroptera being the exceptions.

[22] 'Mémoires pour servir à l'histoire des Insectes,' par M. de Réaumur. 12th Mem. 'Des Galles des plantes et des arbres.' Vol. iii., pp. 413—532; pl. 34—47 (Paris, 1737); vol. iii., pt. ii., pp. 176—333; pl. 34—47 (Amsterdam, 1738).

[23] 'Anatome plantarum,' Marcelli Malpighii. Part ii. 'De Gallis'; pp. 22—50; pls. vi.—xxi., figs. 7—74 (London, 1679).

[24] See 'Economic Entomology.' By Andrew Murray, F.L.S. Aptera, pp. 331—374. (London, n. d. [1877]).

Gall-makers are found amongst two families of the highly specialised Hymenoptera. A few sawflies (Tenthredinidæ) produce galls, but it is to the allied family Cynipidæ that *the* gall-flies *par excellence* belong. The life-history of the Cynipidæ is somewhat varied. It contains parasites (true murderers), inquilines (true burglars), and gall-makers (true house-holders).

The study of the imagos will be found somewhat puzzling to the general entomologist, as there is a very general likeness amongst the species; and even the cuckoo gall-flies, or *Synergi*, which are inquilines (lodgers in galls), greatly resemble the true gall-producers. In several instances Linné [25] and other systematists have taken the one for the other. Other genera of Cynipidæ are parasitic on the Siricidæ, on various Diptera, and on plant-lice (Aphides); but it is with the gall-making species only we are just now concerned. I will, however, take this opportunity of warning the student how

[25] Of the 19 species of *Cynips* described by Linné (Syst. Nat.), 7 only are true gall-makers, the other twelve being either inquilines or parasites. Fabricius noticed 23 species of *Cynips;* many are referable to gall-makers of other orders than Hymenoptera, and there the inquilines, parasites, and gall-makers are equally confused. Neither of these great masters of Entomology referred to Malpighi's remarkably accurate descriptions and figures in his 'De Gallis' (1686).

This note reminds me of a distinguished Essex gall observer, Rev. W. Derham, D.D., F.R.S., &c., Canon of Windsor, and for many years Rector of Upminster, in this county. In his 'Physico-Theology,' altogether a remarkable series of sermons, or Boyle lectures (1711 and 1712), there is much curious information about our Essex gall fauna. Part of one note runs thus:—"Since my penning this I have met with the most sagacious Malpighi's Account of Galls, &c., and find his Descriptions to be exceedingly accurate and true, having traced myself many of the Productions he hath mentioned. But I find Italy and Sicily (his Book *De Gallis* being published after he was made Professor at Messina) more luxuriant in such Productions than England, at least than the Parts about Upminster (where I live) are. For many, if not most of those about us, are taken Notice of by him, and several others besides that I never met with; although I have for many Years as critically observed all the Excrescences, and other morbid Tumors of Vegetables, as is almost possible, and do believe that few of them have escaped me. . . . . ."—'Physico-Theology.' Tenth Ed., p. 386, note z. (London, 1742).

necessary it is to keep each species of gall separate, as it will greatly assist him in his studies until he is conversant with the gall-makers, their inquilines and parasites. How large is the subject will be seen when I mention that the late Francis Walker bred 54 species of insects from the well-known "oak-apple" (gall of *A. terminalis*)[26]; and so with our now commonest oak-gall—the Devonshire or marble gall of *Cynips Kollari*. Up to 1872 but two extra lodgers other than the legitimate inhabitants of this gall were known. In two recent articles[27] I have been able to identify 75 Hymenoptera, 12 Lepidoptera, 13 Coleoptera, 1 Orthopteron, and 2 Neuroptera, in all 103 species; the whole bred from the small world of a *C. Kollari* gall, and still I believe these various tenancies are far from exhausted.

The cycle of life in the gall-making Cynipidæ forms a subject of the greatest biological interest. The older authors were generally astonished, and expressed their inability to find a satisfactory explanation; and it was not until some fifty years since that the various methods of reproduction received that scientific treatment which they deserved. The Cynipidæ and Aphididæ amongst the hexapods divided the interest in being the highest exponents of the various processes of non-sexual reproduction. Professor Owen, who is still amongst us, was the first to employ the term "parthenogenesis"[28]; Professor Huxley[29] made some most important researches on the life-history of the Aphididæ; von Siebold[30] (who also is still with us) and Hartig[31] (who went over to the majority but last year) on the Cynipidæ. The theories of non-sexual

[26] 'Zoologist' iv., p. 1454 (1846).

[27] 'Entomologist' xii. 113 (May, 1879); xiii. 252 (November, 1880).

[28] 'On Parthenogenesis, or the successive production of procreating individuals from a single ovum.' London, 1849. Consult Félix Plateau's 'Etudes sur la Parthénogenèse,' Gand. 1868.

[29] "On the agamic reproduction and morphology of Aphis." 'Trans. Linn. Soc.,' vol. xxii., pp. 193—236, pl. 36—40 (1858).

[30] Germar's 'Zeitschrift für die Entomologie,' vol. iv., pp. 379—381 (1843).

[31] Germar's 'Zeitschrift für die Entomologie,' vol. iii., pp. 322—329 (1842); vol. iv., pp. 396—400 (1843).

reproduction are too complex to be examined or enunciated here ; still this subject has such a great influence on Cynipid life—the whole production of oak galls generally—that I cannot pass on without shortly referring to it, more especially as we have lately received such important additions to our knowledge, through the discoveries of Dr. H. Adler, that a radical reform of our whole nomenclature and arrangement of the gall-making Cynipidæ must follow as a necessary consequence.

It is still a fact that in *Cynips* (*sensu strictu*) and some other genera the male is quite unknown. Hartig satisfied himself of this fact by collecting large quantities of the gall of *Dryophanta disticha* (a species of which the sexual form is still undetermined) ; in one year he bred some 10,000 gall-flies, but he failed to obtain a single male. The late Frederick Smith made similar experiments on *C. Kollari* galls, and I have myself collected these galls by the thousand in the hope of breeding the long-looked-for male *Cynips*, but with no satisfactory result. The circumstantial evidence of parthenogenetic reproduction is therefore incontrovertible ; by this is understood the production of new individuals or fertile ova by virgin females. Similar phenomena are known to occur with insects of several orders, and it holds commonly with many Tenthredinidæ, which are so closely allied to the Cynipidæ. From Hartig's time—the father of cecidology—the Cynipidæ included several agamous or asexual genera besides the usual sexual genera ; amongst the gall-producers such species occurred in about equal proportions. No explanation of this anomaly was forthcoming. In America Osten-Sacken and Walsh tried to cut the knot, and the announcement of the discovery of a male belonging to the genus *Cynips* was made. This species (*C. spongifica*), of which I exhibit male specimens, is by no means, however, a typical *Cynips* as the genus is understood in Europe.[32] Mr. H. F. Bassett[33] was the first to adduce any substantial facts in

[32] Dr. Mayr puts it in the genus *Amphibolips*, Reinhard.

[33] "On the Habits of certain gall insects of the genus *Cynips*." 'Canadian Entomologist,' vol. v., pp. 91—94 (May, 1873).

support of the metagenesis theory mentioned by Dr. Reinhard [34] as more probable than the dimorphic hypothesis which had previously been foreshadowed by Osten-Sacken [35] and in Walsh's papers in the 'Proceedings' of the Entomological Society of Philadelphia.[36] Bassett writes that "from all the above facts I infer that all our species that are found only in the female sex are represented in another generation by both sexes, and that the two broods are, owing to seasonal differences, produced from galls that are entirely distinct from each other." This hypothesis has now been proved to be the true gall-fly history, and in the Cynipidæ we have very distinct exponents of the metagenesis theory or so-called "alternation of generations," which we know is so generally the case with the Scolecida and Hydrozoa.[37] Dr. H. Adler first actually proved the fact with *Neuroterus lenticularis* and *Spathegaster baccarum*,[38] and this important discovery has been followed up with other researches made with various gall-flies on numerous small oak-trees planted in pots; the theory has thus been established in 19—really 38—distinct species. This has revolutionised the whole history of the Cynipidæ. Dr. Adler's remarkable memoir,[39] detailing his observations and with notes on the structure of both the galls and gall-

[34] "Die Hypothesen über die Fortpflanzungsweise der eingeschlechtigen Gallwespen." 'Berliner Entomologische Zeitschrift.' Vol. ix. (1865).

[35] "Ueber die Gallen und andere durch Insecten hervorgebrachte Pflanzen-deformationen in Nord-America." By Baron Osten-Sacken. 'Stettiner Entomologische Zeitung,' vol. xxii., pp. 405—423 (Oct.—Dec., 1861).

[36] Vol. i., pp. 47—72 (Oct., 1861); pp. 241—259 (Sept., 1862). Vol. ii., pp. 33—49 (April, 1863); pp. 443—500 (March, 1864). Vol. iv., pp. 331—380 (May, 1865).

[37] [The words "cyclical propagation," introduced into England by Mr. Meldola in his Annual Address to the Essex Field Club (Jan. 12th, 1882), to denote the idea hitherto known by the awkward phrase "alternation of generations," are so much more convenient, and so neatly express the true nature of the phenomena, that they should be adopted in future by all biologists.—Ed.]

[38] 'Deutsche Entomologische Zeitschrift' xxi. 209—248 (1877).

[39] "Über den Generationswechsel der Eichen-Gallwespen." 'Zeitschrift für wissenschaftliche Zoologie,' vol. xxxv., pp. 151—246; pl. x., xi., xii. (1880).

flies, should certainly be carefully studied. The agamous genera *Aphilothrix*, *Neuroterus*, *Dryophanta*, and *Biorhiza* are but æstival parthenogenetic generations of the sexual genera *Andricus*, *Spathegaster*, and *Trigonaspis*, but Dr. Adler still leaves four species of *Aphilothrix* (*A. seminationis*, Gir., *A. marginalis*, Schlecht., *A. quadrilineatus*, Hart., and *A. albopunctata*, Schlecht.) whose generations, he tells us, are exclusively parthenogenetic—"the alternate sexual generation does not exist." *Cynips* is still untouched. This varying biography and linking of structurally different forms into one species is deeply interesting, and leads to most important considerations and results which we cannot now further follow out.

Amongst the cynipideous gall-makers the genus *Rhodites* limits itself to the rose, and other species produce galls on the bramble, ground-ivy, *Hieracium*, *Potentilla*, poppy, &c.

The larvæ of the Cynipidæ are fat, fleshy, apodal, whitish grubs; they pupate in the galls, without exception.

We have but few British sawflies which produce galls, and I am only able to include three species in our Essex list. These all occur on willows, and are produced by species of the Nematidæ. The very common bean-shaped gall of *Nematus gallicola*, which is so commonly seen projecting from both sides of the leaf of many willows, must be well known to all. Its manner of reproduction is very commonly parthenogenetic, the male *N. gallicola* being excessively rare. The late Mr. F. Smith did not meet with it until 1873, the year before his death; and he worked assiduously at the Hymenoptera for upwards of fifty years. It is somewhat remarkable that a beetle (*Balaninus Brassicæ*) is a very general inquiline, or lodger, in these galls. Unlike the Cynipidæ, the gall-making sawflies do not undergo their metamorphoses within the gall, but the larvæ leave it when full-fed and pupate in the ground. The *Cryptocampi* are an exception; their cocoons are formed within the woody galls.

In the Diptera, as in the Hymenoptera, we have one large gall-producing family—the Cecidomyidæ, whose numerous species are commonly known as gall-gnats. Seventy-six

British species are known to produce galls, and many of these are amongst our most familiar ones,—*e. g.*, the dewberry-stem gall, the willow rose-gall, the beautiful little purse-like gall on the leaves of the meadow-sweet, the ground-ivy leaf-gall, the shining yellow and red nodules on the stems of the bed-straw, &c.; but as I have lately given a synopsis of the British species in the 'Entomologist,'[40] I must refer the reader to that paper for information respecting such species as have not yet been found in our county. Most of the galls made by the Cecidomyidæ are especially noticeable, and, as I have said, many are quite familiar to us; still the gall-gnats themselves are very small, obscure, and easily overlooked by the general naturalist, although a specialist writes of them, "these flies (Cecidomyidæ) are the most elegant and delicate little creatures in the whole of the Diptera." Their life-history is very varied, and as the nature of their metamorphosis is of consequence when breeding the flies, so that the student may know whether they pupate in the gall or otherwise, I have noticed this in the table of species.

Another family of the great order Diptera—the Trypetidæ, whose economy is so especially interesting to the phytologic entomologist—includes a few gall-makers, besides numerous leaf-miners, leaf-blotchers, flower-feeders and fruit-feeders. The bright-coloured, spotted and banded winged, flies are objects of especial beauty, and are easy of specific arrangement. The galls produced by them nearly all occur in the seed-capsules and flower-heads of various Compositæ, and are therefore not very noticeable, but the well-known thistle-stem gall of *Urophora Cardui* is an exception. The Trypetidæ pupate within the galls. Two or three other fly-galls are known, but they call for no especial remarks, except their diversity of habits from their congeners, so we will pass on to the Aphis galls, about which I must also be very brief, although they really deserve a separate paper. The pine-apple-like fir galls and elm and poplar leaf-galls are familiar examples of their productions, but their economy is especially involved and obscure. The interesting biological questions

[40] 'Entomologist' xiii. 146—154 (July, 1880).

connected with their reproduction and whole life cycle were first studied in this country by Newport and Huxley, and at the present time M. J. Lichtenstein is so patiently and successfully tracing some of the Aphides through their various stages of development (which is so abnormal that he has had to employ a peculiar nomenclature of his own to distinguish the seven buddings or pseudo-births in certain genera) that I am sure the members of the Club would welcome a resumé of his researches, but I can now only refer them to Mr. Buckton's three beautiful volumes, recently published by the Ray Society,[41] and to Courchet's memoir[42] before alluded to.

There are several species of *Trioza*, a genus of Psyllidæ (Homoptera), which cause swellings and rollings of leaves, especially of several Compositæ; but the only gall-making species yet noted as British is *T. Walkeri*, Först., whose larva lives in the deformed leaves of buckthorn. The common terminal globularly-swollen leaves of box, so well figured by Réaumur, in which the larvæ of *Psylla Buxi* live, can hardly be called a gall.

Both the Coleoptera and Lepidoptera contain a few gall-producing species. The common cabbage and other cruciferous root-galls are familiar examples of the former, and the knot-grass (*Polygonum*) pod-gall[43] of *Asychna æratella*, and *Laverna decorella*, whose larvæ produce swellings in the stems of various species of *Epilobium*, are the only British exponents of the latter. Further than their departure of habits from other members of their groups, and their special bearing on the various problems connected with gall-growth generally, they afford no peculiar interest from our present point of view, and they will doubtless receive more attention when the coleopterous or lepidopterous fauna of our county is under consideration.

[41] 'Monograph of the British Aphides,' by George Bowdler Buckton, F.R.S., F.L.S., F.C.S., &c. London: Printed for the Ray Society. Vols. i.—iii. (1876—1881).

[42] "Études sur les galles causées par les Aphidiens" par L. Courchet (Montpellier, 1879). Compare reference on p. 111.

[43] 'Entomologists' Weekly Intelligencer,' v. 81 (Dec. 11, 1858).

This paper is by no means exhaustive either in botanical, zoological, or biological detail; still I think enough has been referred to, to show the interest accruing to gall study, and the many intricate problems of the greatest importance still awaiting a satisfactory solution. Should any members of the Essex Field Club feel disposed to make observations or experiments, I shall be pleased to place what little knowledge I have of the subject at their disposal. Further, I shall be pleased to name any collected specimens of galls, which are more easily determined in many cases than the insects themselves, which may be sent to me (to Maldon, Essex), and thus, I hope, make numerous additions not only to our county list, but to the fauna of Britain itself.

As to the present knowledge of our number of species of gall-making insects, Essex compares thus with Britain and with Europe:—

	Europe.	Britain.	Essex.
Cynipidæ	123	53	40
Tenthredinidæ	12	8	3
Tineina	8	2	1
Cecidomyidæ	176	76	30
Mycetophilidæ	1	1	1
Trypetidæ	11	5	2
Muscidæ	5	2	1
Curculionidæ	12	8	5
Aphididæ	12	8	6
Psyllidæ	12	1	0
	372	164	89

In the following synopsis of the galls of the county, I have arranged them under two headings: I. Botanical—in accordance with the names and arrangement in Bentham's 'Handbook of the British Flora,' as being the most generally useful book for the entomological botanist, the minute subdivision of species adopted in some floras not being necessary in this case. A short description, and frequently a figure, of each gall is given under the plant on which it occurs, the name of the gall-maker following the diagnosis. II. Entomological—in the ordinary sequence of the families of the insects form-

ing the galls. I have added a few Essex localities, but these must be taken as being very far from exhaustive; when increased attention is paid to these interesting productions the limits of the distribution of the more uncommon forms will doubtless be greatly extended.[44]

Synopsis of Species.

Part I. Botanical Arrangement.

Ranunculaceæ.

Ranunculus repens, L. Leaf. The palmate segments of the lower leaves are rolled inwards from the base, forming a thickened and hard pseudo-gall. The orange-red larvæ pupate within the gall. Cecidomyia Ranunculi, Bremi. (Fig. 1).

Fig. 1. *Cecidomyia Ranunculi.*

Papaveraceæ.

Papaver Rhœas, L. Capsule. The seed-capsule is much distorted, swollen and hardened. It contains many larvæ cells of the Cynipid, which pupates in the gall. Aulax Rhœadis, Hartig.

Cruciferæ.

Barbarea vulgaris, Br. Flowers. In May the yellow flowers become galled and do not open; the anthers become greatly swollen, and the whole bloom deformed. The yellow larvæ pupate within the gall. Cecidomyia Sisymbrii, Shrank.

[44] [The issue of some projected instructions on the best methods of breeding gall-flies, with hints for the study of the same, is postponed, in order to avoid delay in the publication of this part of the 'Transactions,' but Mr. Fitch has kindly promised to make these matters the subject of a separate communication to the Club.—Ed.]

Brassica oleracea, L. Stem. The stock is covered with irregular swellings or knots; each gall contains a single larva, but frequently a number of galls coalesce and form a composite gall as large as a walnut. The larvæ leave the galls in early spring and pupate in the ground. The destructive cabbage-gall beetle. Ceuthorhynchus sulcicollis, Gyllenhal. (Fig. 2).

Fig. 2.
Ceuthorh. sulcicollis.

Brassica campestris, L. Root-stock. The turnips and swedes are most commonly disfigured by hard swellings on the surface of the "roots"; each of which contains the larvæ of the beetle, but possibly of a different species from the cabbage-gall beetle. The larvæ in the white turnips and swedes differ in colour and slightly in structure. Pupates in the earth. Ceuthorhynchus sulcicollis, Gyllenhal.

Brassica Sinapistrum, Boiss (*Sinapis arvensis*, Eng. Bot.). Root. The stalk is galled just below the ground, causing an irregular, round, white, hard, swelling, which contains generally but a single yellowish-white larva; but two or three galls sometimes coalesce on the same plant. The larva pupates in the ground. Ceuthorhynchus assimilis, Paykull.

Raphanus Raphanistrum, L. Root. Similar swellings, just about the surface of the ground, to the charlock galls. Ceuthorhynchus assimilis, Paykull.

Caryophyllaceæ.

Stellaria Holostea, L. Apical leaves. The terminal leaves are smaller, hardened and closely imbricate, generally discoloured. Brachycolus Stellariæ, Hardy. Mr. Hardy states (Buckton's 'British Aphides' ii. 148):—"During the summer the *Aphis* migrates from the stitchwort to one of the grasses, *Holcus mollis*. Here it likewise revels in the centre of a tuft of leaves, for these leaves, being prevented from receding, embrace each other at their bases like those of a

sedge. In this manner a kind of boat is formed for the protection of the colony. In the autumn the *Aphis* reverts to the Caryophyllacea."

Tiliaceæ.

Tilia Europæa, L. Twig. A round, hard, generally red, swelling of about the size of a pea on the young twigs, more especially on those growing from the roots or base of the trunk. The gall is unilocular, and the larva pupates within it. Sciara Tilicola, H. Loew.

Papilionaceæ.

Sarothamnus scoparius, Wimm. Twig. Black, elongate, bud-shaped galls on the upper twigs; several on one twig. The larvæ pupate within the gall. Asphondylia Sarothamni, H. Loew.

Trifolium repens, L. Leaf. The leaflet is folded longitudinally and thickened, often lighter in colour, around the midrib. The larva quits the leaf and pupates in the earth. Cecidomyia Trifolii, F. Löw. (Fig. 3).

Fig. 3. *Cecidomyia Trifolii.*

Lotus corniculatus, L. Flower. The flower is much enlarged, and does not open, also much greener in colour. The larva pupates in the earth. Diplosis Loti, De Geer.

Rosaceæ.

Prunus communis, Huds. (*spinosa*, Eng. Bot.). Leaf. The leaf is thickened and formed into a pouch or purse, with the midrib for its hinge; mostly red in colour. The orange larvæ pupate in the ground. I have bred many specimens of the gnat. Cecidomyia Pruni, Kaltenbach (undescribed).

Spiræa Ulmaria, L. Leaf. Wart-like swellings on the surface of the leaf projecting both on the upper side and under side, mostly reddish above and white or pale green below. Many on one leaf, but only one larva in each gall, within which it pupates. Cecidomyia Ulmariæ, Bremi. (Fig. 4).

Fig. 4. *Cecidomyia Ulmariæ.*

Rubus fruticosus, L. Stem. A considerable thickening of the stem for an inch or more in length, which is at first green and later becomes brown. The gall is multilocular, and is often very conspicuous in winter, showing the holes from which the gall-flies have emerged. Diastrophus Rubi, Hartig. (Fig. 5).

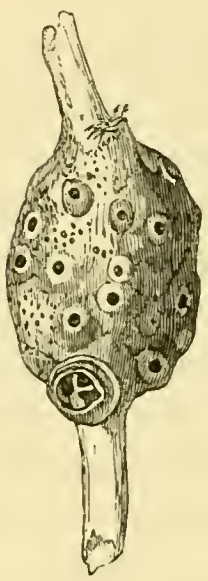


Fig. 5. *Diastrophus Rubi.*

Rubus cæsius, L. Stem. Galls of D. Rubi, as on *R. fruticosus.*

Rubus cæsius, L. Stem. A thickening of the stem, but generally more regularly rounded or oval than in the gall of *D. Rubi;* also mostly much smaller, and does not interfere with the direct growth of the stem, as is often the case with that species. The gall is multilocular, and the larvæ pupate in a snow-white pupa case within it. Lasioptera Rubi, De Geer.

Rubus fruticosus, L. Leaf. Thickened and folded leaf longitudinally along the superior veins. The pale yellow larvæ leave the pseudo gall and pupate in the earth. Cecidomyia plicatrix, H. Loew.

Potentilla reptans, L. Stem and leaf-stalk. Hard, brown, very irregularly shaped, though generally round or oval, swellings of the stem or leaf-stalk; these galls are usually multilocular, and occur singly or more frequently many together on a stem. The gall-flies emerge from the

galls in the May or June of the second year. Xenophanes Potentilla, Villers.

Rosa canina, L. Stem and leaf. The well-known Bedeguar or Robin's pin-cushion occurs on the stem, and frequently single-celled specimens occur as bright red hairy patches on the leaves. The beautiful green and red multilocular galls vary much in size and shape, and the desiccated specimens are often conspicuous objects in the hedges in winter. The gall-flies emerge from the galls in spring. Rhodites Rosæ, Linné. (Fig. 6).

Fig. 6. *Rhodites Rosæ.*

Rosa canina, L. Leaf and leaf-stalk. The smooth, round, pea-sized galls occur generally on the under side of the leaflet, but occasionally on the upper side or on the leaf-stalk, and I once found a specimen on the fruit. They are green in colour, reddish when turned to the sun, but later become brown; their attachment to the leaf is very slight, and when mature they fall to the ground at the least touch. The gall-flies emerge in spring. Rhodites Eglanteriæ, Hartig. (Fig. 7).

Fig. 7. *Rhodites Eglanteriæ.*

Rosa canina, L. Leaf. These galls are somewhat similar to the last, but are beset with from three to six spines of unequal length on their surface. They occur on the under side of the leaflet, and generally resemble those of *R. Eglanteriæ* in situation, size, structure, &c., with the above exception. Rhodites Rosarum, Giraud. (Fig. 8).

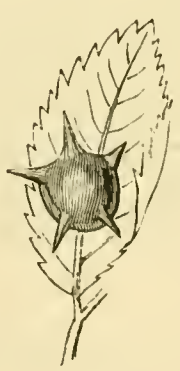


Fig. 8. *Rhodites Rosarum.*

Rosa canina, L. Leaflet. The leaflets are conduplicate — folded longitudinally and thickened, and this pseudo-gall is generally reddish brown in colour. The whitish larvæ quit the leaves and pupate in the ground. Cecidomyia Rosarum, Hardy. (Fig. 9).

Fig. 9.
Cecidomyia Rosarum.

Cratægus Oxyacantha, L. Leaf. The twigs, especially of trimmed hedges, are frequently disfigured with terminal rosettes of leaves; these are much distorted, curled and thickened. The larvæ sometimes pupate in the galled bunch of leaves, but more generally in the earth. Cecidomyia Cratægi, Winnertz.

Onagraceæ.

Epilobium montanum, L. Stem. The stems are swollen in places into hard, round, knots of about the size of a pea, but their growth is hardly interfered with. The white cocoons sticking out of the stem are conspicuous objects after the emergence of the moths. Laverna decorella, Stephens.

Umbelliferæ.

Pimpinella Saxifraga, L. Seeds. One or both seeds are much enlarged and rounded, remaining smooth and green; often several are galled on one umbel. These galls also occur in the umbels of parsnip and carrot. The bright orange larvæ pupate in the ground. Asphondylia Pimpinellæ, F. Löw. (Fig. 10, as it occurs on *Daucus*).

Fig. 10.
Asphondylia Pimpinellæ.

Cornaceæ.

Cornus sanguinea, L. Leaf. The gall consists of a hard, reddish, truncate cone thrust half-way through the leaf, and

plainly visible on both sides. It is multilocular, but the larvæ leave the gall and pupate in the earth. Hormomyia Corni, Giraud.

Stellatæ.

Galium verum, L. Stem. Smooth, shining, somewhat hard, pink or whitish swellings of the stem; single galls are generally more or less round, but several galls mostly occur together. The stem itself is not further distorted; occasionally the galls occur on the flower-stalks. The orange larvæ leave the gall and pupate in the earth. Cecidomyia Galii, H. Loew.

Compositæ.

Achillea Millefolium, L. Leaf axils. These are cup-like, thickened, greenish, or purplish brown, swellings occurring singly or in pairs in the axils of the leaves; the tops of the galls are irregularly coronate, and the larvæ emerge thence and pupate in the earth. Hormomyia Millefolii, H. Loew. (Fig. 11).

Fig. 11.
Hormomyia Millefolii.

Tanacetum vulgare, L. Leaf, stem, flower. The single gall is smooth, green, bell-shaped or ovate, with a notched crown at the apex; it opens here when mature. The walls are thick and fleshy, and each gall contains but one larva; frequently, however, two or more coalesce, and occasionally the stem is completely surrounded with the confluent fleshy galls. The galls mostly occur singly on the midribs and pinnæ of the leaves, or several together in the axils of the leaves, or as a terminal bunch on young plants; more rarely seven or eight galls may be found on the receptacle of the flowers, these generally purple and green in colour. The bright orange larvæ pupate in the earth, but frequently also in the galls. Oligotrophus (Hormomyia) Tanaceticolus, Karsch, or possibly only a variety of H. Millefolii, H. Loew.

Artemisia vulgaris, L. Leaf. Small, red or red and green galls on the upper surface of the lower leaves. The larvæ pupate within the galls. Cecidomyia foliorum, H. Loew.

Carduus arvensis, Curt. Stem. The stem is considerably swollen into a hard, woody, ovate, or globular gall, but the stem continues to grow and leaves are produced above the gall. The gall is most commonly found in cultivated fields. The galls are multilocular, containing from two to eight fat, white larvæ with brown heads, which pupate within the gall. Urophora Cardui, Linné. (Fig. 12).

Fig. 12. *Urophora Cardui.*

Centaurea nigra, L. Flower-head. The ovary is transformed into hard, woody, irregularly oval, confluent galls to the number of two or three in one flower-head. The appearance of the head is not changed, and the galls are only tactilely noticeable. The white larvæ change to black pupæ within the gall. Urophora solstitialis, Linné.

Hieracium umbellatum, L. Stem. Hairy, green, rounded swellings of the stem, generally of about the size of a walnut. The galls are multilocular, and the larvæ pupate therein. Aulax Hieracii, Bouché (= *A. Sabaudi*, Hartig).

Campanulaceæ.

Campanula rotundifolia, L. Seed capsules. The galled capsules are much swollen, and become much thickened and fleshy; they are not, however, particularly noticeable. The black larvæ pupate within the galls, often two in one capsule. Gymnetron Campanulæ, Linné.

Jasminaceæ.

Fraxinus excelsior, L. Leaflets. The midrib of the leaflets is much swollen, enclosing an oval purse-like chamber

in which the gall-gnat larva lives. It emerges from the pseudo-gall and pupates in the earth. Diplosis botularia, Winnertz.

Scrophularineæ.

Veronica Beccabunga, L. Flower-head. The flower-head or seed capsule is transformed into an oval gall of about $\frac{1}{4}$ in. long by $\frac{1}{6}$ in. broad. The yellowish, hairy larva pupates within the gall. Gymnetron Beccabunga, Linné.

Veronica Chamædrys, L. Leaf. The terminal bud, when galled, becomes arrested in development, and is a thickly-haired, whitish-green tuft. The orange-yellow larvæ pupate amongst the closely imbricated woolly leaves, often several in a pseudo-gall. Cecidomyia Veronicæ, Vallot. (Fig. 13).

Fig. 13.
Cecidomyia Veronicæ.

Labiatæ.

Nepeta Glechoma, Benth. (*Glechoma hederacea*, Eng. Bot.). Leaf. Small, hairy, tubular galls, occurring in some numbers on the upper sides of the leaves. When mature the galls readily fall from the leaf, leaving several round holes in it. The single pale yellow larva pupates within the fallen gall. Cecidomyia Bursaria, Bremi. (Fig. 14).

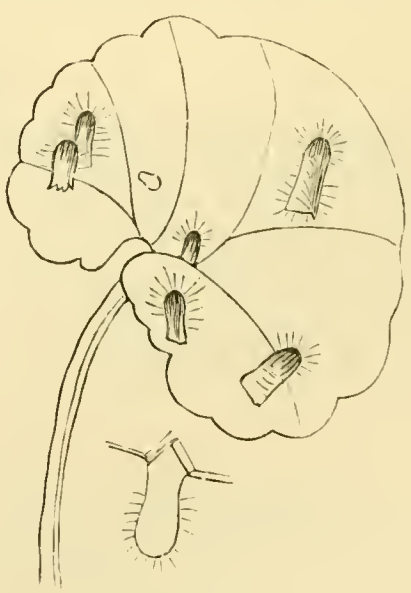


Fig. 14.
Cecidomyia Bursaria.

Nepeta Glechoma, Benth. Leaf, leaf-stalk, stem. Round, oval, or irregularly shaped, hairy, fleshy, green galls, sessile on the leaf-stalk or stem, occupying the place of a leaf, but often with the leaf-edge produced from the gall. The

larva pupates within the mostly unilocular gall. Aulax Glechomæ, Hartig. (Fig. 15).

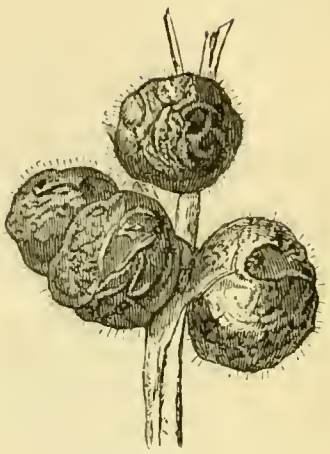


Fig. 15. *Aulax Glechomæ.*

Plantagineæ.

Plantago lanceolata, L. Flower-stalk. Greenish, succulent, oval swellings of the peduncles or flower-stalks. The gall is about $\frac{1}{4}$ in. long by $\frac{1}{8}$ in. in diameter, tapering at both extremities into the stalk; it is strongly ribbed, and is unilocular. The larva pupates within the gall, and the perfect beetle appears in the autumn. Mecinus pyraster, Herbst.

Polygonaceæ.

Polygonum amphibium, L. Leaf. The leaf-margin is thickened or rolled, mostly on both sides, and is orange or red in colour. The larvæ pupate within the gall. Cecidomyia Persicariæ, Linné.

Polygonum Persicaria, L. Leaf. Similar galls to those above described, produced by the same gall-gnat.

Euphorbiaceæ.

Buxus sempervirens, L. Leaf. The leaves are swollen and slightly discoloured. The yellow larvæ pupate within the pseudo-gall. Diplosis Buxi, Laboulbène.

The very common terminal leaf-bladders are produced by Psylla Buxi, Linné.

Urticaceæ.

Urtica dioica, L. Leaf, leaf-stalk, flower-stalk. The galls are mostly globular, hairy, fleshy swellings, either on both surfaces of the leaves themselves, or on the leaf- or flower-stalks, pale green in colour, but frequently rosy; they occur singly or occasionally in masses. The whitish larvæ leave the galls and pupate in the earth. Cecidomyia Urticæ, Perris.

Ulmaceæ.

Ulmus campestris, Sm. Leaves. The galls mostly occur at the ends of twigs on elm bushes or stubs; they consist of much thickened and distorted bunches of leaves, and vary in size from that of a walnut to a fair-sized apple; when fresh they are yellowish green with rosy reflections, and contain a quantity of bluish black mucilaginous liquid, which is liberated with the Aphides when the mature gall splits. The old brown galls are very conspicuous on elm hedges in winter, but they are fitful in appearance, in some years (as 1881) being very abundant, while in others (as 1879 and 1880) they are almost entirely absent. Schizoneura lanuginosa, Hartig.

Ulmus campestris, Sm. Leaf. These galls occur as pedunculate, smooth galls, attached by their thin end to the upper surface of the leaf, somewhat resembling a filbert in size and shape; they change colour, often to a beautiful bright yellow, earlier than the unaffected leaves. They occur singly, but I have rarely found double specimens; unlike the previous species these galls generally occur on trees; they are much rarer than *S. lanuginosa*, but in some years are by no means uncommon. The gall-makers are mature in autumn. Tetraneura Ulmi, De Geer.

Amentaceæ.

Fagus sylvatica, L. Leaf. The gall is a hard, pyriform, or somewhat conical, smooth projection from the upper side of the leaf, but also showing through and firmly attached, so that it falls only with the leaf; it is about the size of a cherry-stone, and there are seldom more than one or two on a leaf. The white larva pupates within the gall during winter. Hormomyia Fagi, Hartig.

Fagus sylvatica, L. The small, hairy, tubular galls occur on the upper side of the leaf, only showing a slight convex projection on the under surface; they are greenish at first, but speedily change to brown or reddish brown in colour, and then fall from the leaf, leaving a white, circular, basal scar

behind (when mature they fall at the least touch). There are generally eight or ten galls on a leaf, occurring on each side of the midrib, mostly in the angle of a side vein. The larva lives in the gall throughout the winter, pupating therein in the spring. Hormomyia piligera, H. Loew.

Quercus Robur, L. Rootlets. The galls when single are about as large as a hazel nut, but they generally occur in confused masses of five or six together. The galls are soft when recent, but soon become hard and woody; they are round, oval, or reniform, pyriform when confluent, and contain from three to nine thin-walled, oval larva-cells, which are yellowish on the inside. The galls are mature in the autumn, and the apterous, ant-like gall-flies emerge therefrom throughout the winter. Biorhiza aptera, Fabricius (Fig. 16) [agamous form of Andricus (Biorhiza) terminalis].

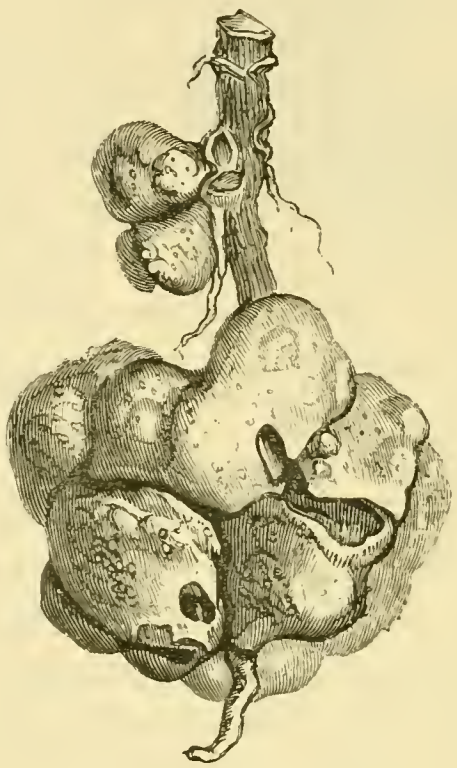


Fig. 16. *Biorhiza aptera.*

Quercus Robur, L. Root. This gall generally occurs just below the surface, where the roots leave the trunk, and is mostly considerably larger than the preceding. It is round, rough, hard, and woody, varying in colour with the surrounding soil from light yellow or reddish to almost black; it somewhat resembles a truffle. In section the gall shows numerous oval larva-cells embedded in its parenchyma. The gall is mature in autumn, and the gall-flies emerge therefrom in April. Aphilothrix radicis, Fabricius (Fig. 17) [agamous form of Andricus noduli].

Quercus Robur, L. Bark. The gall is tooth- or rather nail-like in shape, and is found deeply embedded in the trunks of old oaks, frequently on the bark encircling the spot where a large branch has been removed on old pollards.

When young it is a smooth, succulent, rounded, greenish gall; but when mature it is hard, brownish, really obconical in shape, but on the surface presenting a circular convex lid

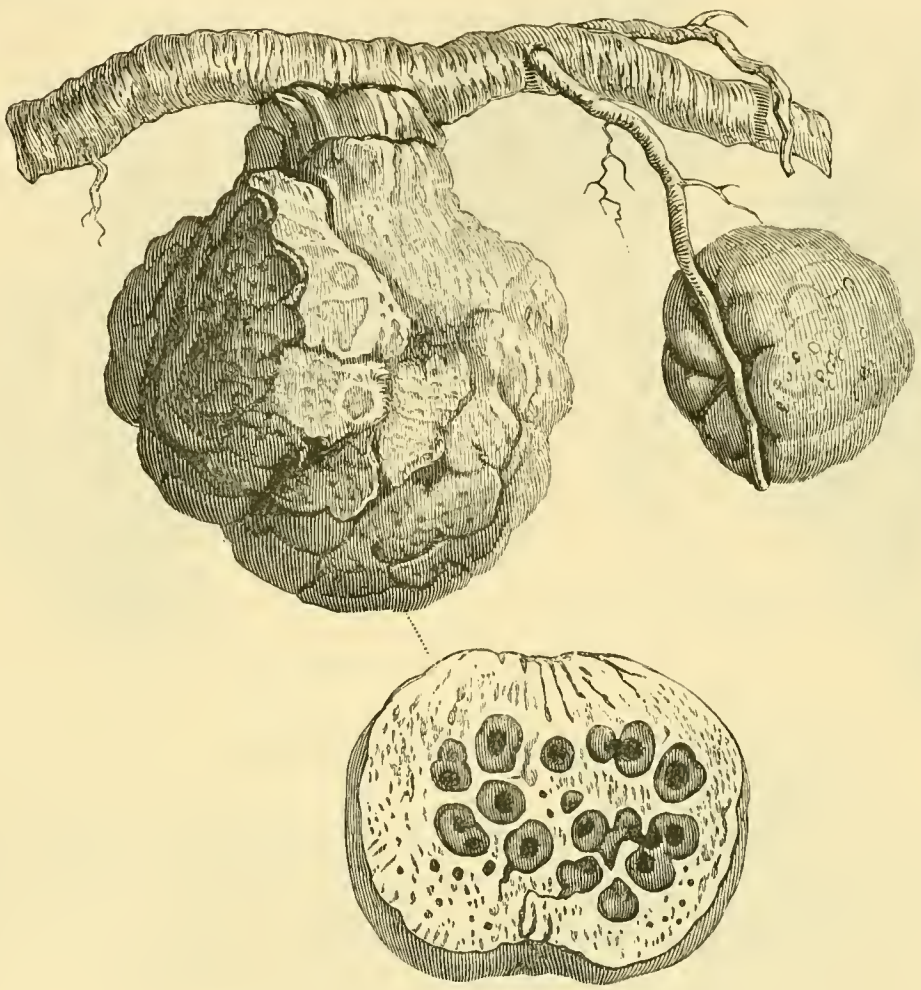


Fig. 17. *Aphilothrix radicis.*

which falls off when mature, showing the pierced, circular, apical, woody septum of the gall surrounded with numerous small, circular punctures, this just below the surface of the bark. The galls are single-celled, but generally occur gregariously; they are mature in autumn, and the gall-flies emerge therefrom in early spring. Aphilothrix corticis, Linné (Fig. 18) [agamous form of Andricus gemmatus, Adler].

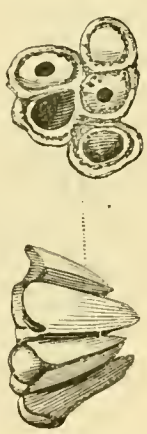


Fig. 18. *Aphilothrix corticis.*

Quercus Robur, L. Bark. Small acorn-like, red or brown galls occurring in clusters on the young offshoots of oak-stubs or the smaller

branches of trees. They are hard, conical, single-celled galls, coarsely furrowed on their basal two-thirds. They never occur singly, and when fresh the galls are deep red in

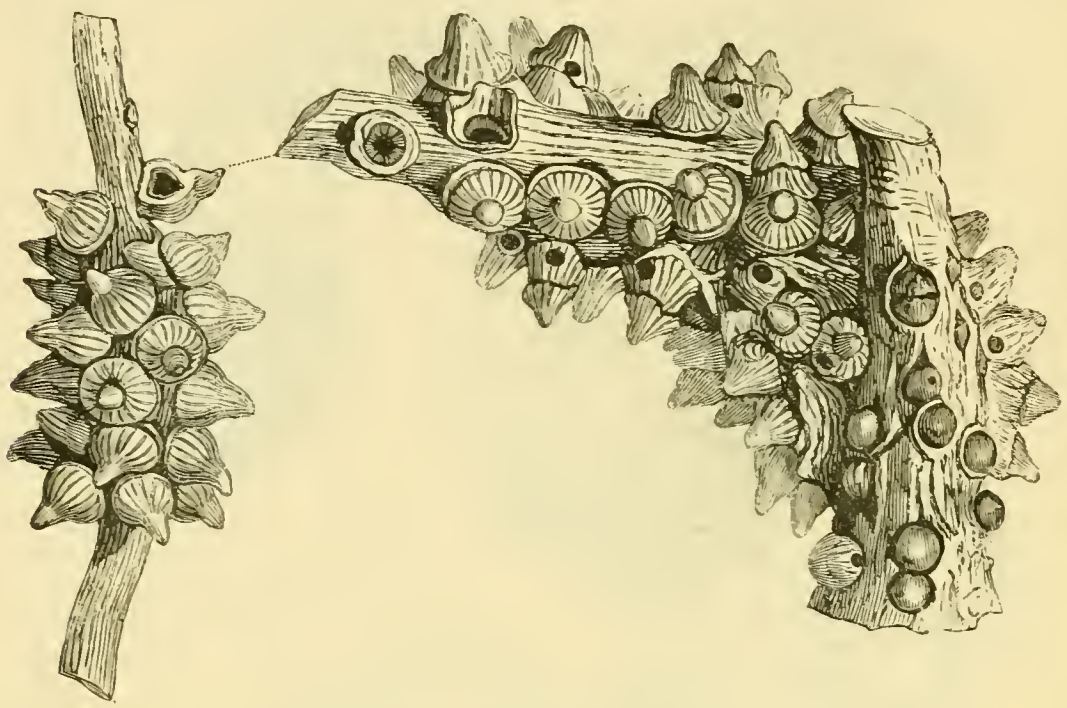


Fig. 19. *Aphilothrix Sieboldii.*

colour, which tint they lose after the emergence of the insect. The galls are mature in September, and the gall-flies emerge therefrom in April or May. Aphilothrix Sieboldii, Hartig (Fig. 19) [agamous form of Andricus testaceipes].

Quercus Robur, L. Stem. The galls are soft, succulent and berry-like, occurring on the trunks of young oaks. They are spherical, pea-sized, bright red or yellowish, and single-celled. The galls, which mature very quickly, really occur on the stem-buds of the oaks in the spring ; they soon shrivel up and disappear after the emergence of the gall-fly, which takes place in June. Trigonaspis megaptera, Panzer. (Fig. 20).

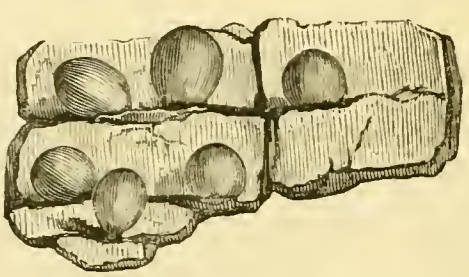


Fig. 20. *Trigonaspis megaptera.*

Quercus Robur, L. Twig. Little, glabrous, oval swellings are frequently noticeable on the bark of oak-twigs, more especially when pierced by the gall-flies ; these are the galls of *Andricus noduli.* This single-celled gall also occurs on

the young shoots and leaf-petioles; it is mature in summer, and the gall-fly emerges therefrom in August to October. ANDRICUS NODULI, Hartig. (Fig. 21).

QUERCUS ROBUR, L. Bud. The smooth, spherical, hard, yellowish brown, bullet gall of *C. Kollari* is now well known everywhere. It is dark or yellowish green when fresh, and occurs on the terminal and axillar buds of the young twigs often in clusters of three or four together. In section the gall, which varies from one-half to an inch in diameter, shows a thick, loose-celled parenchyma with a radiate appearance surrounding one hard-walled, small, round larva-cell. The galls mature in autumn, and the gall-flies emerge therefrom in September and October, and throughout the following spring; the galls do not fall from the twigs upon the emergence of the tenants, but frequently persist even for years. CYNIPS KOLLARI, Hartig. (Fig. 22).

QUERCUS ROBUR, L. Bud. The artichoke gall of the oak is about the size of a

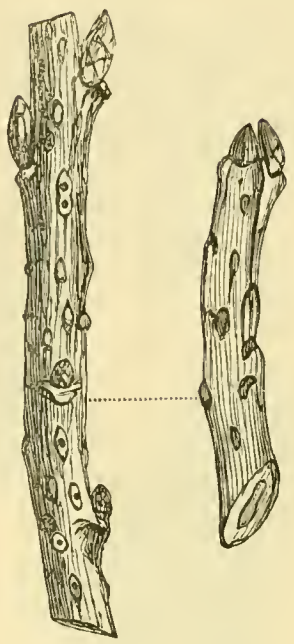


FIG. 21. *Andricus noduli.*

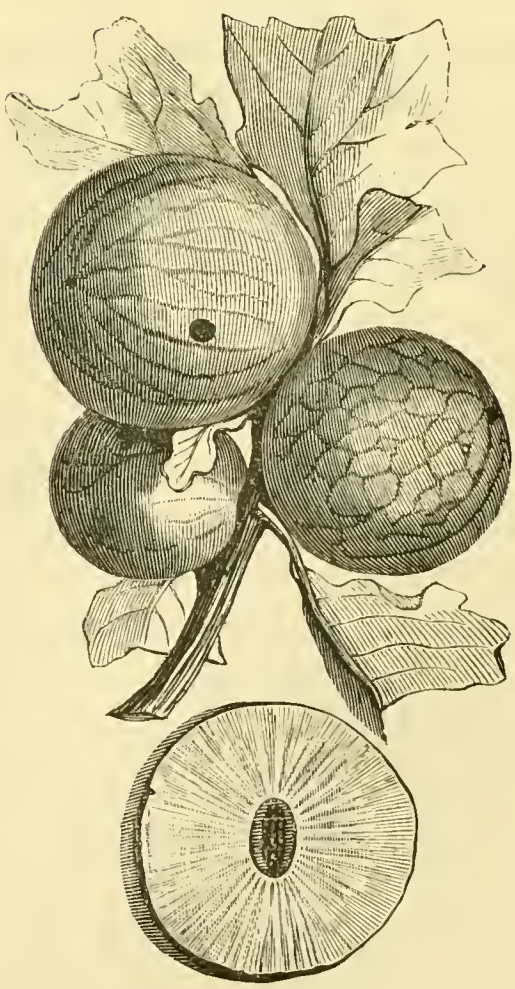


FIG. 22. *Cynips Kollari.*

nut or small walnut, and greatly resembles the fruit of the hop (strobile), or a miniature artichoke. It mostly occurs in the leaf-axils, and consists of a much compressed, woody axis, to which the hairy, brownish green, elongate scales are

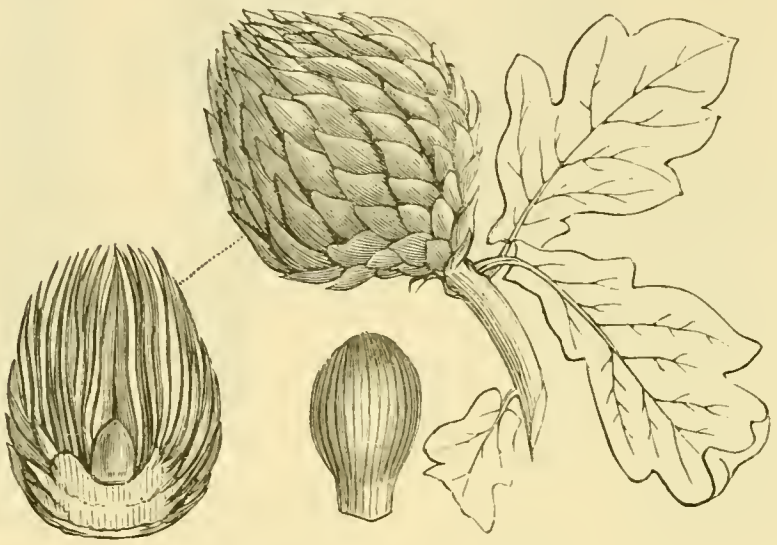


Fig. 23. *Aphilothrix gemmæ.*

attached; these enclose a hard, chocolate-brown, pear-shaped, single-celled inner gall, which is about one-third of an inch in length. The gall is mature in autumn, when the inner gall falls to the ground; the gall-fly emerges therefrom in spring, but occasionally from one- or two-year-old galls. It is commonly found on oak-stubs or young trees. Aphilothrix gemmæ, Linné. (Fig. 23).

Quercus Robur, L. Bud. The gall is a small, woody, spindle-shaped growth in an axillar bud; it is reddish brown in colour and thickly covered with similarly coloured pubescence; at the apex is frequently a small conical papilla, and in some instances there is a short, thick foot-stalk at the base. The gall is single-celled, and is mature in autumn, when the gall-fly emerges therefrom. Aphilothrix solitaria, Fonscolombe. (Fig. 24).

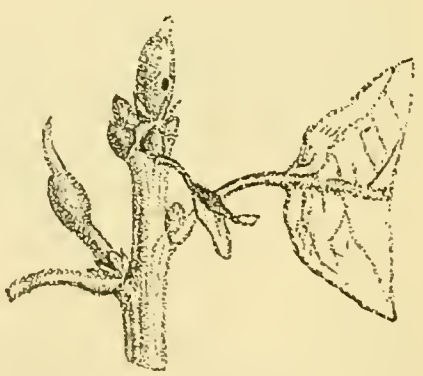


Fig. 24.
Aphilothrix solitaria.

Quercus Robur, L. Bud. This gall is more conspicuous than any other of the smaller autumnal bud-galls, on account

of its bright green colour. It is spherical, with a small apical papilla, and its surface is covered with inconspicuous raised articulations. The gall is sessile in the terminal or axillar buds ; it somewhat resembles a miniature melon. The gall retains its green colour until mature in late autumn ; the gall-fly emerges therefrom in spring. APHILOTHRIX GLOBULI, Hartig (Fig. 25) [agamous form of ANDRICUS INFLATOR].

FIG. 25. *Aphilothrix globuli.*

QUERCUS ROBUR, L. Bud. This gall somewhat resembles that of *A. globuli*, but is purplish green in colour, and in shape and size greatly resembles a grain of wheat ; it is sessile, but more deeply seated in the bud than the above-mentioned species, and is by no means so easily seen, although common. The gall is single-celled, and occurs singly in the autumn ; it is mature in October, and the gall-fly emerges therefrom in April. APHILOTHRIX AUTUMNALIS, Hartig (Fig. 26) [agamous form of ANDRICUS RAMULI].

FIG. 26.
Aphilothrix autumnalis.

QUERCUS ROBUR, L. Bud. The unopened oak-buds are frequently seen to be pierced with a small circular hole ; if on touching the apex a small, woody, brown, smooth, ovate gall is pulled out, we have the inconspicuous gall of *A. collaris*. It is almost impossible to find the galled buds until after the escape of the fly, when they appear to

FIG. 27. *Aphilothrix collaris.*

be not uncommon. The gall is single-celled, and matures apparently throughout the summer, when the gall-fly emerges therefrom. APHILOTHRIX COLLARIS, Hartig (Fig. 27) [agamous form of ANDRICUS CURVATOR].

QUERCUS ROBUR, L. Bud. This most remarkable gall is in size and shape much like a barley-corn, but is green in colour, frequently quartered with red raised stripes, and occurs on a long, but very thin foot-stalk, though sometimes

FIG. 28. *Aphilothrix callidoma.*

almost sessile. It is developed from the axillar buds, and is single-celled; it matures in summer and autumn; the gall-fly emerges therefrom in spring. APHILOTHRIX CALLIDOMA, Hartig (Fig. 28) [agamous form of ANDRICUS CIRRATUS].

QUERCUS ROBUR, L. Bud. This is the most conspicuous of the bud-like galls. It occurs on the twigs of the oak-stubs in the spring, and is somewhat oviform in shape, of about the size of an orange pip; it is green, purplish or whitish green, in colour, commonly covered with short, whitish, longitudinally placed spots; its surface is smooth, and it is sessile in the bud, the bud-scales scarcely showing; there is a well-marked papilla at the apex. The gall is single-celled; it falls from the twig to the ground in May or June, and the gall-fly emerges therefrom in November. APHILOTHRIX ALBOPUNCTATA, Schlechtendal. (Fig. 29.)

FIG. 29.
Aphilothrix albopunctata.

Quercus Robur, L. Bud. The well-known oak-, or King Charles', apple, is a spongy textured, whitish or rosy, almost spherical gall, occurring commonly on the terminal buds in May and June; it varies in size, from that of a pea to a

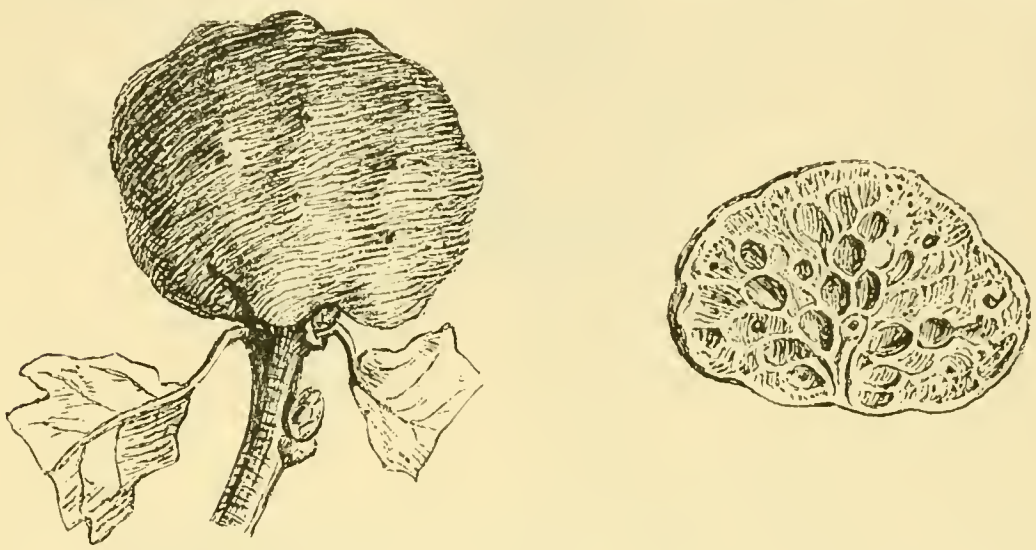


Fig. 30. *Andricus terminalis.*

medium-sized apple. The gall is many-celled, and is mature early in June, when the gall-flies emerge therefrom. Andricus terminalis, Fabricius. (Fig. 30.)

Quercus Robur, L. Bud. This gall has the appearance of a terminal swelling of the young oak shoots, but is truly a bud gall, although axillar buds and leaves are produced from its surface. In section the gall shows the surrounding woody growth, with an elongate apical cavity, at the base of which we find the single, brown, ovate larva-cell. The gall is mature in spring, and the gall-fly emerges therefrom in June. (Fig. 31.)

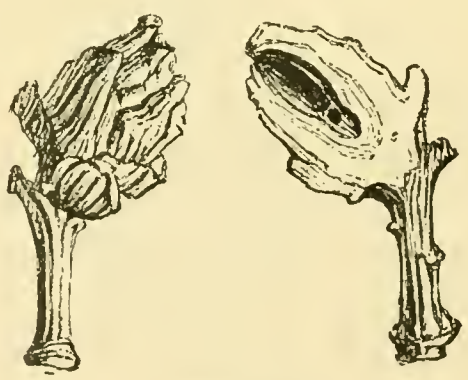


Fig. 31. *Andricus inflator.*

Andricus inflator, Hartig.

Quercus Robur, L. Leaf. Small, reniform, green or red, succulent, but not soft, galls, occurring on the under side of the side veins and midribs of the leaf, from which, when mature, they are very easily detached. They occur in

numbers on a leaf, but each gall is single-celled. The galls are mature and fall from the leaf in autumn; the gall-flies emerge therefrom in June. BIORHIZA RENUM, Hartig (Fig. 32) [agamous form of TRIGONASPIS MEGAPTERA].

FIG. 32. *Biorhiza renum.*

QUERCUS ROBUR, L. Leaf. Early in the year some oak leaves are occasionally noticed to curl up and become considerably shortened; if examined it will be noticed they have a spherical, smooth, green, pea-sized swelling at their base; frequently the whole leaf is galled, and two, three or more galls are confluent. In section this succulent gall exhibits a moderately thin walled cavity, which contains two thin, small, brown, cocoon-like larva-cells, separated by a very thin septum. Certain specimens of this gall might be taken for a bud-gall, but if closely examined the midrib of the leaf is generally noticeable. The galls are mature in spring or early summer, and do not fall from the twig; the gall-flies emerge therefrom in June or July. ANDRICUS CURVATOR, Hartig. (Fig. 33.)

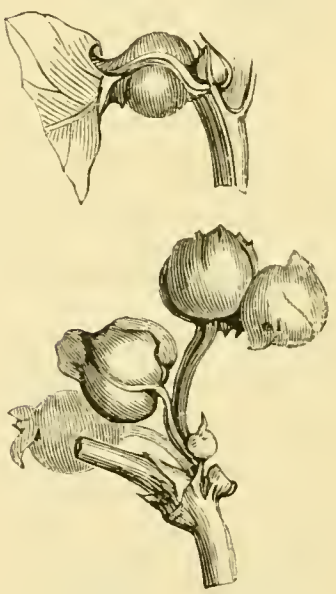


FIG. 33. *Andricus curvator.*

QUERCUS ROBUR, L. Leaf. The common cherry-gall of the oak is a succulent, spherical, smooth, green or rosy gall, of about the size of a cherry; it occurs on the under side of the oak leaf, generally singly, but sometimes three to five are found on one leaf. It is single-celled.

gathered before mature the gall shrivels considerably;

it ripens in September or October, and the gall-flies emerge in late autumn. Dryophanta scutellaris, Olivier, or

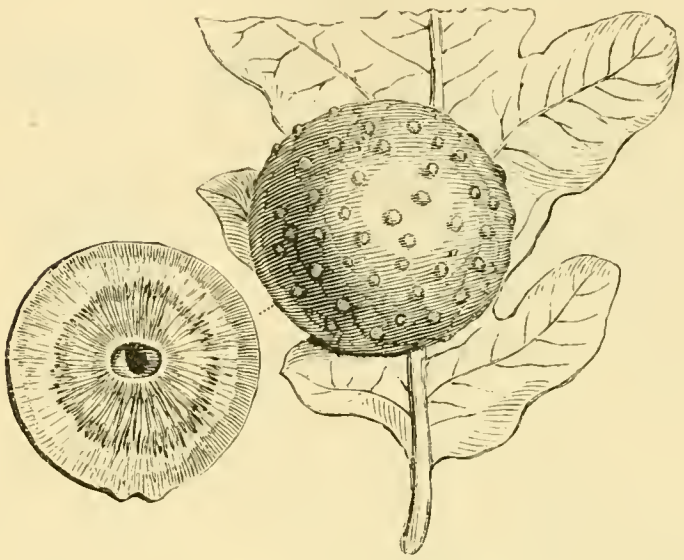


Fig. 34. *Dryophanta scutellaris* or *D. folii*

D. folii, Linné (Fig. 34) [agamous form of Spathegaster Taschenbergi].

Quercus Robur, L. Leaf. This gall is almost spherical, slightly depressed at the top and bottom, glossy, smooth, yellowish or reddish in colour, and occurs mostly in numbers on the under side of the leaf. It is about the size of a tick bean, and is single-celled, but the larva-cell is very large relatively to the size of the gall. This peculiarity and its much harder consistency distinguish it at once from the previous species, of which it is only about half the size, and is much more gregarious than *D. scutellaris* (*folii*). The galls occur in summer, and are mature in early autumn, but

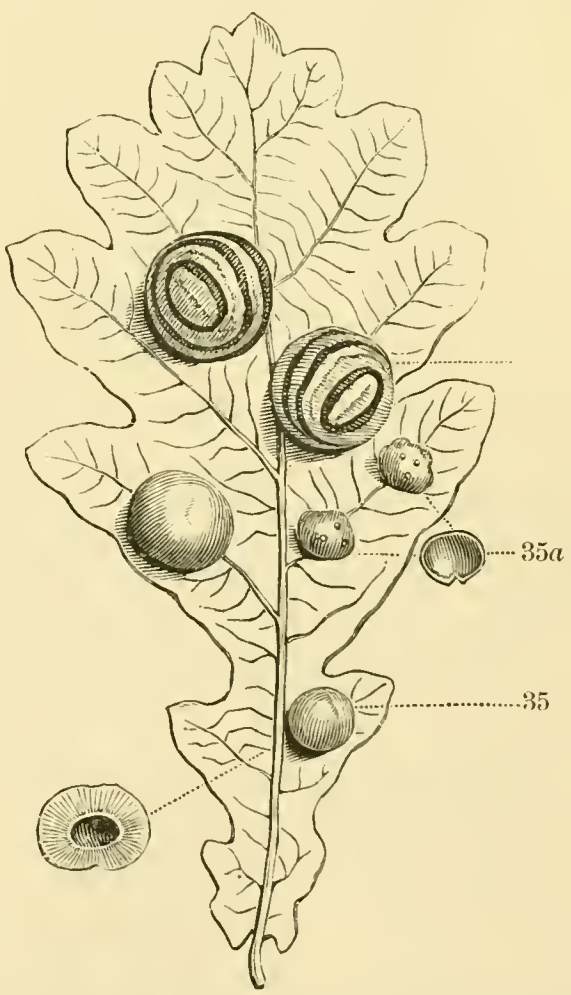


Fig. 35. *Dryophanta divisa.*

they do not become detached from the leaf. The gall-fly emerges from the gall in October and November. Dryophanta divisa, Hartig (Fig. 35) [agamous form of Spathegaster verrucosa].

Quercus Robur, L. Leaf. Galls very similar to those last described are frequently found on the under side of the oak leaf, but only singly, and they are not smooth, but mostly covered with irregular nodules. In section they also exhibit very thin walls to the larva-cell, and are generally considerably smaller than the galls of *D. divisa*, and are not so brightly coloured. The gall is mature in early autumn, and the gall-flies emerge therefrom in October. Dryophanta agama, Hartig (see Fig. 35*a*), sexual form unknown.

Quercus Robur, L. Leaf. The common "silk-button" galls occur in numbers on the under side of the leaf, to which they are attached by a very minute foot-stalk; the gall is round, with a depression in the centre, and its surface is covered with smooth, silky, brown hair; hence its popular name from its resemblance to a brown, silk-covered button. When mature it has a diameter of about the eighth of an inch; it falls to the ground in the autumn, and the larva feeds and grows in the single larva-cell throughout the winter; the gall-fly leaves the gall in March. Neuroterus numismatis, Olivier (Fig. 36) [agamous form of Spathegaster vesicatrix].

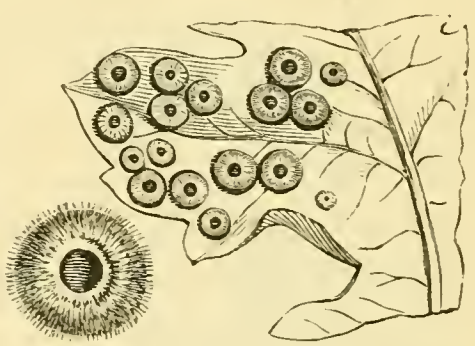


Fig. 36. *Neuroterus numismatis.*

Quercus Robur, L. Leaf. These galls occur in numbers on the under side of the leaf as almost flat, circular discs, yellowish in colour, but their upper surface is covered with short, reddish-brown, stellate hairs. They are commonly known as the "oak spangles." The galls fall from the leaf in autumn. When mature they measure about one quarter of an inch in diameter; the larvæ feed and change to pupæ during winter, and the gall-flies emerge from the galls in

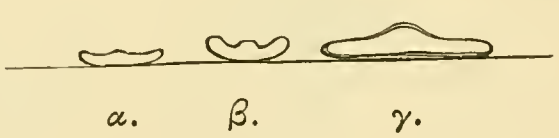
March. NEUROTERUS LENTICULARIS, Olivier (Fig. 37) [agamous form of SPATHEGASTER BACCARUM].

FIG. 37. *Neuroterus lenticularis.*

QUERCUS ROBUR, L. Leaf. This spangle-gall greatly resembles the common spangle-gall last described, but in shape it is raised from the surface of the leaf at its margins; it is reddish or purplish in colour, and does not generally occur in such immense numbers on a leaf. The gall-fly emerges from the fallen gall in March. NEUROTERUS FUMIPENNIS, Hartig (Fig. 38) [agamous form of SPATHEGASTER TRICOLOR].

FIG. 38. *Neuroterus fumipennis*

QUERCUS ROBUR, L. Leaf. Another closely-allied spangle-gall. It differs from the common species in shape, and in being smaller and of a more yellowish or cream-colour; it is a concave disc, with a small raised knob in the centre. The accompanying figures of an imaginary section of each of these three closely-allied spangle galls will help in their differentiation. In Fig. 39, α. represents *N. fumipennis*, β. *N. laeviusculus*, and γ. *N. lenticularis*.



α. β. γ.

FIG. 39.

This species, like its congeners, emerges from the gall in March or April. NEUROTERUS LÆVIUSCULUS, Schenck (Fig. 40) [agamous form of SPATHEGASTER ALBIPES.]

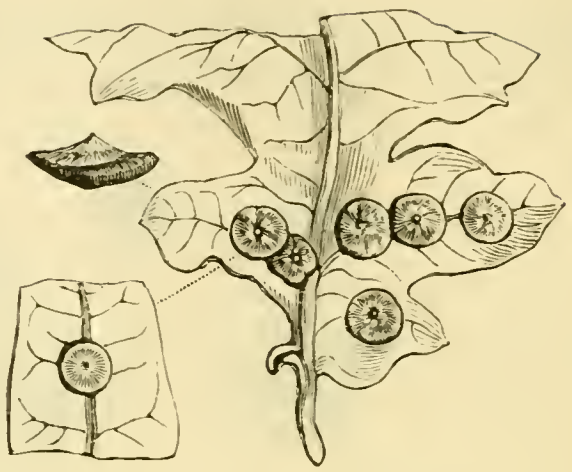


FIG. 40. *Neuroterus læviusculus.*

QUERCUS ROBUR, L. Leaf. This small gall is attached to the mid or side ribs of the leaf on its under side. It is egg-shaped or oval, smooth, hairless, yellow or brownish, and often covered with bright red or purplish spots; when mature it is about one-tenth or one-eighth of an inch in length. The young gall is enclosed in a thin membrane, which splits lengthwise, and the scar on the leaf-vein is readily observable after the fall of the mature gall in early autumn. It is single-celled, with a relatively large cavity; the gall-fly emerges therefrom in November or December. NEUROTERUS OSTREUS, Hartig (Fig. 41) [agamous form of SPATHEGASTER APRILINUS].

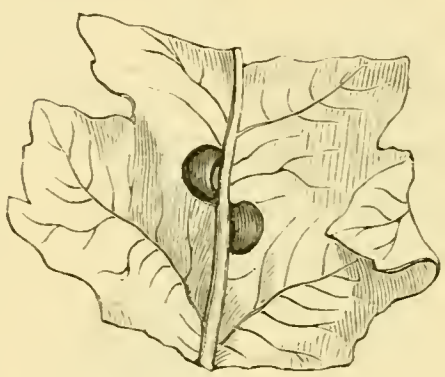


FIG. 41. *Neuroterus ostreus.*

QUERCUS ROBUR, L. Leaf and male flowers. The common "oak currant" gall is a smooth, sappy, green (frequently more or less red on the catkin specimens), translucent, spherical gall of about the size of a large pea; it occurs on the under side of the leaf (where it is contexturate with it above, exhibiting a well-defined, convex, succulent swelling of the surface) and on the catkins, generally four or five specimens on a single leaf or catkin. It has a single larva-cell, which is small; the gall grows very quickly, and the gall-fly emerges therefrom

in June, just before the catkins fall. SPATHEGASTER BACCARUM, Linné. (Fig. 42.)

FIG. 42. *Spathegaster baccarum.*

QUERCUS ROBUR, L. Leaf. This gall resembles green leaf-specimens of the former species (*S. baccarum*) in every respect, except that its surface is thickly covered with fine, soft, whitish hairs. The gall is mature in early summer, and the gall-fly emerges therefrom in July and August. SPATHEGASTER TRICOLOR, Hartig. (Fig. 43.)

FIG. 43. *Spathegaster tricolor.*

QUERCUS ROBUR, L. Leaf. The small gall of this species occurs at the margin of the young leaf, generally near its base. It is smooth, oval, and yellowish, somewhat resembling a white mustard seed, except in shape (which is more oval). The gall, which is single-celled and thin-walled, is mature in spring, and the gall-fly emerges therefrom in June. SPATHEGASTER ALBIPES, Schenck. (Fig. 44.)

FIG. 44. *Spathegaster albipes.*

Quercus Robur, L. Leaf. This inconspicuous blister-gall occurs as a circular swelling of the leaf on both sides. The mature gall is about one-eighth of an inch across, by about one-twentieth thick, and is yellow in colour, but is green, like the leaf, when immature; on the upper side radiate striations are frequently noticeable. The gall is mature in spring, and the gall-fly emerges therefrom in June. Spathegaster vesicatrix, Schlechtendal. (Fig. 45).

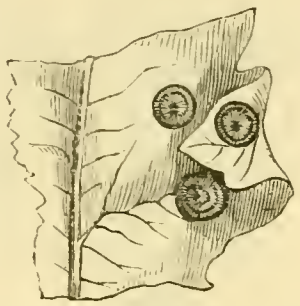


Fig. 45. *Spathegaster vesicatrix.*

Quercus Robur, L. Male flowers. In May and June we often notice, as it were, small locks of sheep's wool in the oak trees, where no sheep could get. These are the galls of *A. ramuli.* The gall is really a hard, woody, irregularly-shaped mass, consisting of many confluent larva-cells; but its whole small surface is covered with this thickly-matted, yellowish-white, woolly growth, so that the mass is often as large as a walnut or small apple. The gall is attached to a catkin; it is mature in June, and is many-celled, the gall-flies emerging therefrom in June and July. Andricus ramuli, Linné. (Fig. 46.)

Fig. 46. *Andricus ramuli.*

Quercus Robur, L. Male flowers. Small, oviform, rarely almost spherical, smooth, but more or less deeply ribbed longitudinally according to their stage of maturity, brown, greenish-brown or reddish, succulent galls, occurring in some numbers on a catkin-stem; they are mostly sessile, but occasionally have a short footstalk, which rarely is found

considerably lengthened. The gall is single-celled, and when mature in June falls with the catkin, but the gall-fly does not emerge therefrom until the succeeding spring. ANDRICUS QUADRILINEATUS, Hartig. (Fig. 47.)

FIG. 47. *Andricus quadrilineatus.*

SALIX ALBA, L. Leaf. The bean-shaped galls on the leaf are very common, and generally well known. They are oval or bean-shaped, and occur four or five in a row on each side of the midrib (with which, however, they have no connection), but sometimes only singly; the galls are thick and fleshy, projecting both from the upper and under surface of the leaf, but more so from the under side; here they are generally green or whitish-green and pubescent, above they are bright red. Only one larva lives in a gall, eating the fleshy walls to a mere shell, when it bites a hole through and falls to the ground, where it pupates in a thick brown cocoon. The sawfly appears in May and September, being double-brooded. NEMATUS GALLICOLA, Westwood. (Fig. 48.)

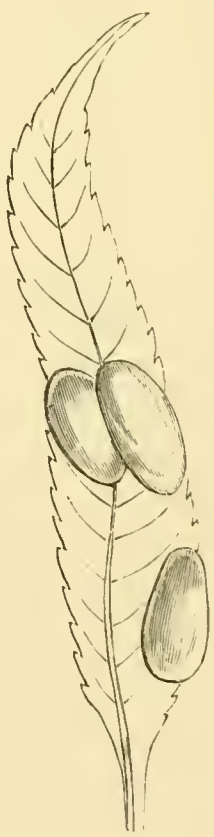


FIG. 48.

Nematus gallicola.

The galls of this species occur commonly on *Salix fragilis*, L.; those on *S. Caprea*, which are similar, but not so

fleshy and thick, probably belong to a closely-allied, but distinct species.

Salix alba, L. Leaf. The margins of the leaves are twisted and considerably thickened. This pseudo-gall is the work of the larva of Cecidomyia clausilia, Bremi. (Fig. 49.)

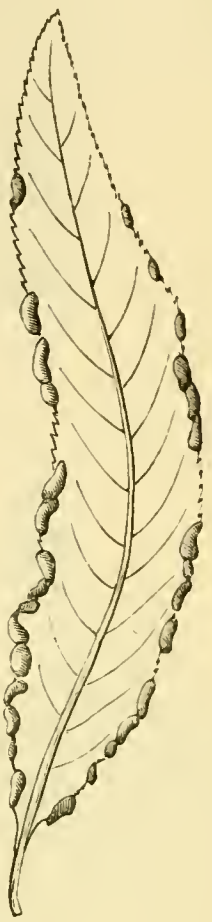


Fig. 49.

Cecidomyia clausilia.

Salix alba, L. Terminal leaves. The willow "rose-gall" is too well known to need detailed description, but it is more than probable that we have two or three closely-allied species whose respective galls are not clearly differentiated. The common form is the well-known tuft of terminal leaves or leaf-rosette which is so conspicuous an object at the end of the twigs of our common pollard and other willows, especially so on the bare twigs during winter. The gall consists of an imbricate mass of shortened, sessile, and crowded leaves; in the centre is a small, hard, inner gall, which contains one or more larvæ of the gall-gnat; the larvæ pupate within the gall in spring, and the imagos emerge therefrom in May or June. Cecidomyia rosaria, H. Loew. Similar galls occur on *S. fragilis*, *S. Caprea*, and other willows.

Salix Caprea, L. Twigs. More or less globular, woody swellings of the twigs of this sallow are frequently noticeable: these are commonly the work of the gall-gnat mentioned below, but more rarely of a sawfly; these latter most commonly occur on older twigs than the former. More than one larva occur in the galls; they pupate therein in thin brown cocoons in April, and the sawflies emerge therefrom in May and June. Cryptocampus pentandræ, Retzius.

Salix Caprea, L. Twigs. The commonly found hard, woody, irregular, and variable swellings of the twigs of the sallow and other willow species are the work of gall-gnats.

These galls are multilocular; the larvæ pupate in the gall, and the imagos emerge therefrom in May. CECIDOMYIA SALICIS, Schrank.

SALIX CAPREA, L. Leaf. Small, hard, pustular galls, occurring on the side veins of the leaf, often in considerable numbers; they are about the size of a small hemp-seed when single and mature; are conical in shape, projecting both on the upper and under side of the leaf; are hard and woody, and pale greenish in colour. The gall is single-celled, but we very commonly find large numbers confluent together; sometimes the gall takes the form of a much-thickened, hard midrib, extending the whole length of the leaf, and occupying half its extent; often yellowish or red in colour. Such galls are frequently left attached to the twigs during winter, and then show the numerous small round holes from which the larvæ have emerged; they leave the galls in autumn and pupate in the earth, the flies appearing in May. HORMOMYIA CAPREÆ, Winnertz.

SALIX CAPREA, L. Leaf. Round, hairy, green, rarely reddish, thin-walled, succulent galls, occurring on the under side of the leaf, attached only at one point, and showing as a discoloured spot above. In rare cases the gall is produced on the upper side of the leaf, and then is smooth and rosy. Each gall is tenanted by a single larva, which eats a small circular hole through, and quits it in September; it pupates in a cocoon in the earth, and the sawfly appears in May or June. NEMATUS VIMINALIS, Linné. (Fig. 50.)

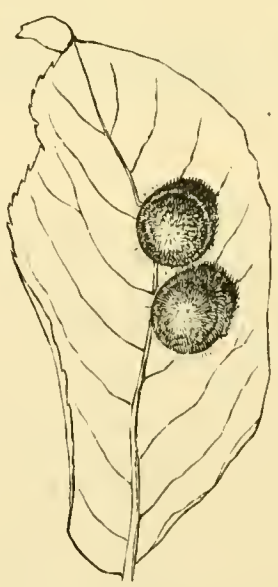


FIG. 50. *Nematus viminalis.*

We probably have other "pea" gall-makers in the county, but these closely-allied *Nemati* and their distinctive galls are but indifferently known in this country. The sallow "rosette" galls are also probably distinct from those above referred to, as occurring on *S. alba*, *S. fragilis*, &c.

Populus nigra, L. Leaf-stalk. The petioles of the leaves are swollen into pea-sized, hollow galls, which split when mature, and liberate the aphidious tenants. Pemphigus bursarius, Hartig.

Populus nigra, L. Leaf-stalk. The galls on the petioles are twisted into a spiral form, and are not so thick and discoloured as the above-mentioned species. Pemphigus spirothecæ, Koch.

Coniferæ.

Abies communis, L. Bud. The "pine-apple" galls on our common spruce are best known in their old woody condition, as they remain on the tree for some time after the Aphides have quitted them. When fresh the gall resembles a small green cone, as it consists of a mass of short, fleshy, ovate, imbricate leaves at the base of a young branch; these enclosed cavities open when the gall is mature, and liberate the Aphides in early summer. Adelges Abietis, Linné.

Taxus baccata, L. Terminal leaves. At the end of a branch we often find a rosette of crowded and somewhat shortened leaves. The gnat larva lives within the bases of the leaves, and pupates therein in spring; the gall-gnats emerge from the "artichoke" galls in June. Cecidomyia Taxi, Inchbald.

Gramineæ.

Triticum repens, L. Top shoot. In autumn or winter we find the imbricate, closely-sheathed leaves of a top shoot converted into a more or less cylindrical hard gall, which tapers towards both ends, attaining a length of from one to one and a half inch. In this country one of the parasitic Eurytomidæ (Chalcididæ) has been given as the gall-maker, which is undoubtedly a Dipteron, and is probably Lonchæa parvicornis, Meigen.

Synopsis of Species.

Part II. Entomological Arrangement.

Hymenoptera. Cynipidæ.

Rhodites, Hartig.

R. Eglanteriæ, Hart. Gall on *Rosa*. Common.

R. Rosarum, Gir. Gall on *Rosa*. Generally distributed, but not common.

R. Rosæ, L. Gall on *Rosa*. Very common.

Aulax, Hartig.

A. Glechomæ, Hart. Gall on *Glechoma*. Birdbrook, Burnham, Widford.

A. Rhœadis, Hart. Gall on *Papaver Rhœas*. Hockley.

A. Hieracii, Bouché (*Sabaudi*, Hart.) Gall on *Hieracium*. Steeple Bumpstead, Danbury, Thundersley.

Xestophanes, Förster.

X. Potentillæ, Vill. Gall on *Potentilla*. Danbury, Epping Forest.

Diastrophus, Hartig.

D. Rubi, Hart. Gall on *Rubus*. Generally distributed, but not common.

Andricus, Hartig.

A. gemmæ, L. Gall on *Quercus*. Common.

A. globuli, Hart. Gall on *Quercus*. Hadleigh, Hazeleigh, Hockley, Mundon.

A. inflator, Hart. Gall on *Quercus*. Generally distributed, but not common.

A. radicis, Fabr. Gall on *Quercus*. Maldon, Rayleigh.

A. noduli, Hart. Gall on *Quercus*. Common.

A. Sieboldi, Hart. Gall on *Quercus*. Birdbrook, Maldon, Rayleigh, Thundersley.

A. corticis, L. Gall on *Quercus*. Maldon, Rayleigh.

A. COLLARIS, Hart. Gall on *Quercus*. Maldon, Rayleigh.
A. CURVATOR, Hart. Gall on *Quercus*. Common.
A. AUTUMNALIS, L. Gall on *Quercus*. Maldon, Rayleigh.
A. RAMULI, L. Gall on *Quercus*. Generally distributed, but not common.
A. CALLIDOMA, Gir. Gall on *Quercus*. Maldon, Rayleigh.
A. SOLITARIUS, Fonsc. Gall on *Quercus*. Maldon.
A. QUADRILINEATUS, Hart. Gall on *Quercus*. Loughton, Maldon, Rayleigh, Woodford.
A. ALBOPUNCTATUS, Schlecht. Gall on *Quercus*. Maldon, Rayleigh.
A. OSTREUS, Gir. Gall on *Quercus*. Generally distributed, but not common.

CYNIPS, Linné.

C. KOLLARI, Hart. Gall on *Quercus*. Very common.

TRIGONASPIS, Hartig.

T. MEGAPTERA, Panz. Gall on *Quercus*. Epping Forest, Mundon, Woodham.
T. RENUM, Gir. Gall on *Quercus*. Birdbrook, Burnham, Cricksea, Danbury, Maldon, Rayleigh, Widford.

BIORHIZA, Westwood.

B. TERMINALIS, Fabr. Gall on *Quercus*. Very common.
B. APTERA, Fabr. Gall on *Quercus*. Maldon, Rayleigh.

DRYOPHANTA, Förster.

D. FOLII, L. (*scutellaris*, Oliv.). Gall on *Quercus*. Generally distributed, but not common.
D. DIVISA, Hart. Gall on *Quercus*. Generally distributed, and common.
D. AGAMA, Hart. Gall on *Quercus*. Hockley, Maldon.

NEUROTERUS, Hartig.

N. LENTICULARIS, Oliv. Gall on *Quercus*. Very common.
N. BACCARUM, L. Gall on *Quercus*. Very common.

N. FUMIPENNIS, Hart. Gall on *Quercus*. Common.
N. TRICOLOR, Hart. Gall on *Quercus*. Rayleigh.
N. LÆVIUSCULUS, Schenck. Gall on *Quercus*. Maldon, Rayleigh.
N. ALBIPES, Schenck. Gall on *Quercus*. Maldon.
N. NUMISMATIS, Oliv. Gall on *Quercus*. Very common.
N. VESICATRIX, Schlecht. Gall on *Quercus*. Maldon.

HYMENOPTERA. TENTHREDINIDÆ.

NEMATUS, Jurine.

N. GALLICOLA, Westw. (*Vallisnierii*, Hart.). Gall on *Salix*. Very common.

N. VIMINALIS, L. (*pedunculi*, Hart.). Gall on *Salix*. Generally distributed, but not common.

CRYPTOCAMPUS, Hartig.

C. PENTANDRÆ, Retz. (*medullarius*, Hart.). Gall on *Salix*. Maldon.

LEPIDOPTERA. TINEIDÆ.

LAVERNA, Curtis.

L. DECORELLA, Steph. Gall on *Epilobium*. Generally distributed, but not common.

DIPTERA. CECIDOMYIDÆ.

CECIDOMYIA, Meigen.

C. BURSARIA, Bremi. Gall on *Glechoma*. Birdbrook, Widford.
C. ? CLAUSILIA, Bremi. Gall on *Salix*. Maldon.
C. CRATÆGI, Wtz. Gall on *Cratægus*. Very common.
C. GALII, H. Loew. Gall on *Galium*. Birdbrook, Maldon, Rayleigh.
C. FOLIORUM, H. Loew. Gall on *Artemisia*. Grays (W. F. Gwinnell). See 'Proc. Essex Field Club,' ii., pp. xvi., xx.
C. PERSICARIÆ, L. Gall on *Polygonum*. Burnham, Canewdon, Cricksea, Maldon; Canvey, Foulness and Wallasea Islands.
C. PLICATRIX, H. Loew. Gall on *Rubus*. Maldon.
C. ? PRUNI, Kalt. Gall on *Prunus*. Maldon.

C. Ranunculi, Bremi. Gall on *Ranunculus*. Maldon.
C. Rosaria, H. Loew. Gall on *Salix*. Common.
C. Rosarum, Hardy. Gall on *Rosa*. Maldon.
C. Salicis, Schrank. Gall on *Salix*. Generally distributed, and common.
C. Sisymbrii, Schrank. Gall on *Barbarea*, &c. Birdbrook, Romford.
C. Taxi, Inchbald. Gall on *Taxus*. Greensted, Maldon.
C. Trifolii, F. Löw. Gall on *Trifolium*. Maldon.
C. Ulmariæ, Bremi. Gall on *Spiræa*. Steeple Bumpstead, Maldon, Rayleigh, Woodham Walter, Widford.
C. Urticæ, Perris. Gall on *Urtica*. Very common.
C. Veronicæ, Vallot. Gall on *Veronica*. Birdbrook, Danbury, Loughton, Maldon.

Diplosis, Loew.

D. botularia, Wtz. Gall on *Fraxinus*. Birdbrook, Maldon.
D. Buxi, Lab. Gall on *Buxus*. Birdbrook.
D. Loti, DeGeer. Gall on *Lotus*, &c. Epping Forest, Maldon.

Asphondylia, Loew.

A. Pimpinellæ, F. Löw. Gall on *Pimpinella*, &c. Maldon.
A. Sarothamni, H. Loew. Gall on *Sarothamnus*. Brentwood, Epping Forest, Mountnessing.

Hormomyia, Loew.

H. capreæ, Wtz. Gall on *Salix*. Maldon, Rayleigh.
H. Corni, Gir. Gall on *Cornus*. Helions Bumpstead.
H. Fagi, Hart. Gall on *Fagus*. South Benfleet.
H. Millefolii, H. Loew. Gall on *Achillea*. Maldon.
H. piligera, H. Loew. Gall on *Fagus*. Danbury, Epping Forest.
Oligotrophus Tanaceticolus, Karsch (possibly *H. Millefolii*, var.). Gall on *Tanacetum*. Maldon.

Lasioptera, Meigen.

L. Rubi, Heeger. Gall on *Rubus*. Birdbrook, Burnham, Canewdon, Colchester, Maldon, Ongar, Rayleigh, Widford, Woodham.

DIPTERA. MYCETOPHILIDÆ.

SCIARA, Meigen.

S. TILICOLA, H. Loew. Gall on *Tilia*. Maldon, Woodham Mortimer.

DIPTERA. TRYPETIDÆ.

UROPHORA, Robineau-Desvoidy.

U. CARDUI, L. Gall on *Cirsium*. Maldon, Rayleigh, Canvey and Wallasea Islands.

U. SOLSTITIALIS, L. Gall on *Centaurea*. Birdbrook, Danbury, Rayleigh.

DIPTERA. MUSCIDÆ.

LONCHÆA, Fallen.

L. PARVICORNIS, Meig. ? Gall on *Triticum*. Maldon, Rayleigh.

COLEOPTERA. CURCULIONIDÆ.

CEUTHORHYNCHUS, Schönherr.

C. ASSIMILIS, Paykull. Gall on *Sinapis*. Common.

C. SULCICOLLIS, Gyll. Gall on *Brassica*. Very common.

GYMNETRON, Schönherr.

G. BECCABUNGÆ, L. Gall on *Veronica*. Rainham (T. R. Billups).

MIARUS, Schönherr.

M. CAMPANULÆ, L. Gall on *Campanula*. Danbury.

MECINUS, Germar.

M. PYRASTER, Herbst. Gall on *Plantago*. Rainham (T. R. Billups).

HEMIPTERA. APHIDIDÆ.

BRACHYCOLUS, Buckton.

B. STELLARIÆ, Hardy. Gall on *Stellaria*. Maldon.

SCHIZONEURA, Hartig.

S. LANUGINOSA, Hart. Gall on *Ulmus*. Generally distributed, and common.

PEMPHIGUS, Hartig.

P. BURSARIUS, Hart. Gall on *Populus*. Generally distributed, but not common.

P. SPIROTHECÆ, Koch. Gall on *Populus*. Heybridge, Maldon, Rayleigh.

TETRANEURA, Hartig.

T. ULMI, DeGeer. Gall on *Ulmus*. Generally distributed, but not common.

ADELGES, Vallot.

A. ABIETIS, L. Gall on *Abies*. Common.

[The whole of the cuts of Oak-galls illustrating this paper were kindly lent by Messrs. West, Newman & Co. The Editor is indebted to Miss Ormerod for the cuts of *Cecidomyia Ranunculi* and *Ceuthorhynchus sulcicollis*. The remaining blocks were engraved expressly for this paper. —ED.]

XIV. The Mammalia of Essex; A Contribution towards a List of the Fauna of the County.

By Henry Laver, M.R.C.S., F.L.S.

[Read December 17th, 1881.]

The Rev. Richard Lubbock, in commencing his account of the Fauna of Norfolk, remarks that a sketch of the Mammalia of a county "may be comprised within a narrow compass—species grow gradually scarcer and scarcer. When we look at the trim fences and high cultivation of great part of this district (Norfolk), a wide stretch of imagination is necessary to carry the mind back to days departed, when the urus, the bear, and the wolf ranged the forest, or traversed the marsh, pursued by hunters nearly as savage as themselves."[1] Our own county of Essex was, we are sure, the home of these same wild animals, the urus, the bear, and the wolf, and we may also place with them the wild hog, red deer, and roebuck, as creatures which have been the unfortunate victims of that rigorous cultivation mentioned above, which is found to be necessary to the sustenance and happiness of the higher creature, man. Cultivation and enclosure have been carried in Essex to greater completion than in most parts of England, and with the exception of Epping Forest there is no extensive tract of woodland in the county. Our wild and predaceous animals have in consequence been diminished or exterminated, earlier than in more favoured spots, where forests, mountains, and marsh have protected them and delayed that extinction which is inevitable before many years have expired.

It is, I think, a good idea to take stock, if I may be allowed the expression, of our diminishing fauna before the dying out of any more of our wild animals occurs; and in another

[1] ['Observations on the Fauna of Norfolk, and more particularly on the District of the Broads.' By the late Rev. Richard Lubbock, M.A., Rector of Eccles. Norwich, 1845. New Edition, 1879.—Ed.]

manner it may be useful, by directing attention to the various mammals remaining to us, especially as the class Mammalia is a branch of Natural History the study of which is almost entirely neglected in this country.

Ask any countryman, or even any well-educated person living in the country, how many species of mice there are in Britain, and not one in ten thousand will be able to answer the question. Even amongst those paying some attention to Natural History, nearly the same ignorance prevails; birds, butterflies, and moths, occupying their interest, generally to the exclusion of other and equally attractive subjects.

It is not surprising that the beautiful branches of Natural History are attractive to amateur students, but why is it that the mammals are so neglected? It may be that they are not found everywhere, as are butterflies and birds, and that they are more difficult to capture and preserve. On the other hand, these species are not so numerous, and any trouble and care expended on them will be quite as profitably employed as in the pursuit of more favoured creatures, for the study of Nature in her various forms is ever an unfailing source of pleasure to those whose minds are fortunately endowed with a taste for enquiry into her laws.

"I am not vain enough to suppose that I can add much to the zoological knowledge which is yearly becoming more general amongst us. Yet it is from local Faunas—from notes made by different observers in various districts as to the frequency or scarcity of species in the counties in which they reside—that the master naturalist must build up his system for a nation. The humblest attempt therefore is not without its portion of utility." These are the opinions of the Rev. R. Lubbock, in the preface to his Norfolk Fauna, and the words must serve as my apology for presenting the following remarks to my brother naturalists.

The order and classification adopted is that of the authors of the last edition of Bell's 'British Quadrupeds,'[2] which is the standard work on the subject.

[2] ['A History of British Quadrupeds, including the Cetacea.' By Thomas Bell, F.R.S., F.Z.S., &c. Second edition, revised by the author,

CHEIROPTERA. VESPERTILIONIDÆ.

SCOTOPHILUS NOCTULA. The Great Bat.—This Bat, the largest of the British Cheiroptera, occurs here commonly. It is said to have a shorter period of activity than most of the order, but my experience is, that it comes out of its winter haunts in March if the season is favourable, and continues on the wing until late in October; it is to be seen flying over the river and this town, and in fact all through the valley of the Colne, in abundance, until quite the end of the month, in suitable seasons. The latest period at which I have obtained a specimen was on the 10th of November. I never find any other species hybernating with it; hollow trees appear to be its favourite resting-places, but I know a few spots where it may always be found resting between chimneys and the walls of houses. I think it is one of our most beautiful bats, the rich brown fur, smoother and finer than velvet, contrasting well with the black wings. In flight it is like the swift, rapid and high, and it well merits Gilbert White's name *altivolans*.[3]

SCOTOPHILUS PIPISTRELLUS. The Common Bat.—This Bat, a small edition of the noctule, is here, as elsewhere, the

Robert F. Tomes, and Edward R. Alston. London, 1874. In the original manuscript Mr. Laver had prefixed short specific diagnoses to his remarks upon each species, but the Editor has expunged these as being unnecessary: the generic and specific characters are admirably given in Bell's work, which should, of course, be in the hands of all students of our native Mammalia. A considerable amount of information on the habits and food of some of our mammals will be found in Mr. Harting's paper on "Forest Animals," 'Transactions,' i. 74.—ED.]

[3] [See 'Natural History of Selborne,' Letters XXII., XXVI., and XXXVI. Sir William Jardine remarks:—"The British fauna is indebted to White for the first notice of this species; it is locally distributed, and although not common generally is found in numbers together, so many as 185 having been taken in one night from the eaves of Queen's College, Cambridge. It was first described by Daubenton under the name of '*La noctule*,' which name Latinised was afterwards continued, and is prior to White's name of *Vespertilio altivolans*, which we regret has not been retained, as it is so characteristic of the habits of the species."—ED.]

commonest of the order, appearing earlier and retiring later than any other, and it is the species most frequently seen by day. It is on the wing in mild seasons nearly up to Christmas, when it finally retires for its winter sleep, choosing almost invariably holes in and about buildings for its home. The flight, unlike that of its larger relative, is low, and well described by its common name, "Flitter Mouse"; the sheltered sides of buildings or hedges being favourite hunting-grounds, no doubt in consequence of its food, gnats and small insects seeking the same protection from the wind.

Vespertilio Nattereri. Reddish-grey Bat.—This easily distinguished species is reputed to be rare; in this district, however, it is one of our commonest bats. Houses and buildings are favourite hiding-places in summer; and in winter, cellars, caverns (as under Colchester Castle), and such places, are generally chosen. Occasionally bats are brought to me late in autumn, drawn up in the buckets of our deepest wells, and three out of four being of this species I have good reasons for believing that the crevices in the brickwork of the wells are occasionally chosen as *hybernacula*. I hear the peculiar note of this bat, during its evening flight, more frequently than any other in the streets and gardens of Colchester.

V. Daubentonii. Daubenton's Bat.—This also is not a rare bat in this district. It has one character by which it may be distinguished easily: the wing membrane extends only to the distal extremity of the tibia, leaving the foot free, instead of the membrane being continued to the root of the toes, as is usually the case in other species. Daubenton's bat has been well described as an aquatic species; its habit of haunting water, either stagnant ponds or running streams, flitting with rapid vibrations of the wings a very few inches from the surface, and apparently spending most of its time of flight there, makes the description "aquatic" a just one. Their usual habitats when at rest are in buildings. In winter I find them, as did Yarrell, under our castle at Colchester. Some that I have endeavoured to keep appeared

delicate, and soon died; perhaps they required aquatic insects, or it may be they could not bear confinement. The whole family appear equally unfitted for close confinement, and I find great difficulty in keeping bats alive for any considerable length of time.

V. MYSTACINUS. Whiskered Bat.—This, again, is much more common than is generally believed; I have no difficulty in finding all that I have required for the purposes of study. Its flight is very similar to that of the Pipistrelle; like that bat it hawks under the shelter of a hedge or row of trees, and I have no doubt is constantly passed over by those seeking it as the commoner species. Buildings appear to be its usual habitat.

PLECOTUS AURITUS. Long-eared Bat.—There is no difficulty in distinguishing this common bat: the remarkable ears, as long as the body, cause it to be unmistakable. There is no animal in existence, so far as I know, with ears in this proportion, except a long-eared bat, *P. homochrous*, which occurs in the Himalayas, and it is questionable whether this latter is a true species; if it is only a variety, then the animal under consideration is, in respect of ears, unique. Although the ears are so large, they do not strike one as being so disproportionate as those of the lop-eared rabbit, which are really small by comparison. *Plecotus auritus* is very common in the Colchester district, and usually has its haunts in buildings, although I have had them brought me from hollow trees. It is a mild and gentle creature, and not difficult to tame. It is the bat most frequently caught in houses, having entered the room by the open window, often much to the consternation of female members of the household.

BARBASTELLUS DAUBENTONII. The Barbastelle.—I have found this bat early in April flitting slowly, and in an apparently purposeless manner, near the ground, under the protection of a plantation; and this style of flight is one means by which it may be distinguished. Its dark colour makes it appear much larger than it really is; and now that I have learned to recognise it I do not consider it so rare as

it is usually believed to be, although I cannot call the Barbastelle a common bat. The ears of the preceding species were remarkable for their size: these for the manner in which they are united across the forehead of the animal; and this is a character which assists us to recognise it, especially if we bear in mind that this bat's fur is darker than that of any other British species. It is very solitary in its habits, and haunts trees principally. I have never seen it except away from the town, and I find it useless to search for where I have seen it flying the previous night.

Cheiroptera. Rhinolophidæ.

Rhinolophus ferrum-equinum. Greater Horse-shoe Bat. —This bat is stated—in both editions of 'Bell's Quadrupeds,' and also in 'Cassell's Natural History'—to occur at Colchester. I believe that some mistake was made by Yarrell with regard to the locality of his specimen; the animal is so distinct in flight, and so unmistakable in the hand, that I do not think I am in error in affirming that neither of the horse-shoe bats occurs in this district. They are plentiful in the western counties, and I know many places in which I have seen both species in abundance.

Insectivora. Erinaceidæ.

Erinaceus Europæus. Hedgehog.—This well-known animal is common everywhere, in spite of the constant persecution of game preservers. There can be no doubt it occasionally helps itself to an egg, or a young partridge or pheasant; but its depredations in this respect are quite compensated for by the good it does in destroying grubs, slugs, and insects. Taken altogether it may be considered as a very harmless and useful little creature. I know no animal that so soon becomes tame and familiar when in confinement.

Insectivora. Talpidæ.

Talpa Europæa. Common Mole.—This useful animal is very common in all parts of the county, although in every district it is subjected to great persecution, as the farmers

object to its burrowing and casting up mounds in their pastures and newly-sown fields. I am not aware of any other mischief done by this creature in Essex, except, it may be, that it disarranges and blocks up the land-drains by burrowing under them. In other parts no doubt considerable mischief has arisen by this industrious little miner boring through embankments made to keep out water, necessitating every means being taken to keep down its numbers. The hillock which covers the nest of the mole is generally made in a hedge or wood, but sometimes in the open field; it may usually be known by its size being so much greater than the ordinary "mole-hill." The young are from three to six in number, and are produced in the spring; they are born naked, but grow very rapidly. When young they are able to fast a considerable time; I have had some brought me alive that were taken out of the nest the day before, and of course had been without food for many hours, a privation which would have been speedily fatal had they been full-grown. I have purchased of one mole-catcher (who works in company with his brother) in one season fifteen hundred fresh skins; and this will give some idea of the enormous number destroyed by an able man. There is in this district a family of mole-catchers, the greatest masters of their art I have ever known: at any time they will produce living specimens on having a few hour's notice. Their name is "Watch'em" (watch them), a nick-name no doubt given them in consequence of their trade. They are hereditary mole-catchers, the family having followed this trade for more than 150 years.

Insectivora. Soricidæ.

Sorex vulgaris. Common Shrew.—The colour of this animal varies very much, hardly two specimens being of exactly the same shade. It occurs commonly in all parts of the county, but is more frequently heard than seen: like all the rest of the family it is very pugnacious, rarely two meeting without a fight resulting, and their shrill war shrieks are often audible in hedge or coppice as evidence of these encounters.

Sorex pygmæus. Lesser Shrew.—There can be no doubt of the specific distinctness of these two shrews (*Sorex vulgaris* and *S. pygmæus*), and the most easy character to distinguish them is the comparative length of tail. I find them both equally common, either as captured specimens or as dead on the paths in autumn. The colour of the tips of the teeth is not an important point, as it varies much with age; but I think the hair on the lower parts of *S. pygmæus* will be generally found to be a clearer white than is the case in *S. vulgaris*.

Sorex fodiens. Water Shrew.—This interesting little animal occurs in all parts of the county in suitable localities, usually preferring shallow stagnant waters to quickly running streams; but it is found occasionally at some distance from water. It is amusing to watch its hunting for food in the half-dry marsh ditches, and I have seen it very commonly in those about Paglesham and Wallasea Island. It is an expert swimmer, but seems to prefer running about underneath the water, and this it does as freely and with as great apparent comfort as on dry land, using its long snout to turn over any substance which may hide its prey. Its food consists principally of beetles, their larvæ, and other insects, as well as fresh-water Crustaceans.

Sorex remifer (the Oared Shrew), formerly considered distinct, is only a dark specimen of *S. fodiens*, according to the latest authorities.

Carnivora. Ursidæ.

Meles taxus. The Badger.—This animal, so well known to most of us by the accounts we have heard from persons of a previous generation, is well-nigh extinct in this country, where fifty years since it was very common: clearance of woods, diminution of hedges, and excessive game preserving, are the most effective causes of this extermination; and game preserving, as now carried on, will, I fear, not only blot out the poor badger, but every other animal called *vermin*, by ignorant game-keepers and their masters, whether useful or not. Within the last year two badgers have been

taken in the Colchester district, and quite recently one was caught between Colchester and Harwich, at Bentley; but these individuals were, I fear, our last survivors of a race which gave much sport to our ancestors, or, perhaps we should say, gave opportunity for the exhibition of much brutality. In my younger days I saw a few baitings, but it certainly did not strike me that any great amount of suffering was inflicted on the badger; the dogs, especially those new to the work, gave unmistakable evidence that they did not like the badger's jaws.

CARNIVORA. MUSTELIDÆ.

LUTRA VULGARIS. Common Otter.—This animal also, in Essex, is becoming rare, not on account of the value of our coarse fish on which it lives, but in consequence of the ease with which it may be taken in a steel trap, and so be made into a "specimen" to adorn the hall wall,—a horrible "stuffed" effigy of its former graceful self. It has occasionally appeared lately in the Colne River, close to this town, and several have unfortunately been destroyed at Ford Street. It occurs also in the Stour, Chelmer, Blackwater, and Lea. It is certainly one of our most interesting and graceful animals when swimming in its native streams. It is astonishing that so large an animal is able to slip into the water so quietly, not making half the wake that a rat does; but so it is, and anyone who is fortunate enough to see a mother and family playing in clear water, as I have more than once, will I am certain agree with me that it is one of the most interesting sights possible. Otters are usually nocturnal in their habits, like the rest of the family, and I have heard an old gentleman say that when the ground was covered with snow he tracked an otter for miles in its passage from pond to pond where it had travelled during the night. This occurred in Dengie hundred, at a time when ponds containing fish, or at all events eels, were much more common than now, and when almost every field had its pond.

MUSTELA VULGARIS. Common Weasel.—A character sufficient to enable one at a glance to distinguish this animal from the stoat is afforded in the coloration of the *tail*, which

is of the same reddish brown tint as the upper surface of the body. An additional distinction is found in the usually smaller size of the weasel, a character, however, which is not invariable, as I have seen weasels quite the average stoat size, and full-grown stoats as small as undersized weasels. This is another of the so-called "vermin," and the weasel is destroyed whenever met with,—a great mistake, in my opinion, as its prey consists principally of the smaller mammals. Its food is not, however, confined to these, as I have found beetles, lizards, slow-worms, and other small fry in the stomachs of those I have examined. I believe it is very rare for the weasel to interfere much with game; and even if it did much damage in this respect, it could never cause half the jealousies, quarrels, and miseries produced by the excessive preservation of game. In some parts of England it is, when small, called a "mouse-hunter," and well it deserves this name. When chasing a mouse it keeps to the scent as well as the best fox-hound, and seems quite regardless of onlookers. I have said "keeps to the scent;" perhaps I ought to have said it never passes over the scent, even when in full gallop. The manner of its chasing a mouse, in all cases that I have observed, is by making casts diagonally across the mouse's track; and this plan of hunting, I have an idea, is not confined to the weasel. In spite of persecution this little animal is common in all parts of Essex, on the marshes especially so; and there I have found evidences in casts that it is not unfrequently eaten by herons.

Mustela Erminea. The Stoat.—This bloodthirsty, active, and destructive member of a specially bloodthirsty family, is very common throughout Essex, persecution on all sides appearing to have little influence on its numbers. Its food and habits are similar to those of the weasel, but I fear I cannot defend it from the charge of being very destructive to game. Although mice and such small creatures contribute to its sustenance, still I think the larger mammals, as hares, rabbits, and rats, are its favourite prey, which it chases by scent, as most who have lived in the country will have had opportunities for observing. Hares and rabbits, after being

chased for some distance, appear to resign themselves to their fate without further efforts to escape; whether they are paralysed by fear or exhaustion, or both, I am not sure, but they certainly sit still and allow the little hunter to attack them without attempting to defend themselves except by screams. In winter, in this country, I have often observed the change to white to have occurred, but more frequently the change is not complete, some red marks still remaining on the head or shoulders. The number of young is about four or five, and more playful little creatures than a family of young stoats it would be difficult to find.

Mustela putorius. The Polecat.—This destructive animal, both to poultry and game, is becoming very rare in Essex, in many districts being quite extinct, even in spots where a few years since I remember it as being pretty frequently met with. There is very little difference in appearance between the dark ferret and the polecat, and the probability is that the ferret is simply a domesticated polecat, but domesticated in a warmer climate than ours; and this, no doubt, accounts for the greater susceptibility to cold in the domesticated animal. A part of this tenderness is doubtless due to the warmer conditions under which ferrets are reared; for I always found my ferrets, which were reared in an open pig-stye, were not the shivering creatures one usually sees, and I often observed them tumbling and rolling in the snow apparently without discomfort. The food of the polecat is as varied as is that of the other members of this family, and also includes fish, frogs, and other reptiles, according to some authorities.

Martes foina. Common Marten.—This very graceful creature is now I fear extinct in Essex,[4] but as it is exclusively nocturnal it may have escaped notice. In its habits it differs from the other members of this family, they almost universally confining their hunting manœuvres to the ground; but the marten climbs trees with more than the agility of the

[4] [The last recorded Essex specimen of the Marten was killed in Epping Forest in 1853. See 'Transactions,' i. 95.—Ed.]

squirrel, and preys principally on birds, which it surprises when roosting. It also differs in not giving out the disgusting odour we usually associate with this family, and which has, amongst our native members, its greatest development in the polecat. Accounts of captures of martens are very unsatisfactory, as we cannot feel sure which of our two native species (if species they are) is referred to; but I think the species under consideration is the one intended by Lubbock in his 'Fauna of Norfolk,' first published in 1845. He says "it still is occasionally found in Essex."

Carnivora. Canidæ.

Vulpes vulgaris. Common Fox.—It is quite unnecessary to give any specific account of this fortunately common member of our fauna, as it is so well known by sight to almost every one. I say "fortunately common," and may it long remain so, being the object of a sport which does so much to bring all classes together, encourages the breeding of horses, trains our young men as fearless riders, and does not make its votaries selfish and suspicious, as is the case in shooting, fishing, and most other sports. As far as I know the pursuit of the fox and its preservation are the causes of no damage to anything except a little poultry and game; but the advantages are so manifest that we must be content to give these in exchange. So long as there are woods in the country, and the present condition of agriculture gives no reason to suppose they will be destroyed, so long will there be foxes, unless the game preserver takes to using strychnine, and so destroys the sport of the many for a day or two's grand battue during the year; but I hope we may never see this. Many anecdotes are related of the sagacity of this animal, but I need not go into them, as the fox's cunning is proverbial.

Carnivora. Phocidæ.

Phoca vitulina. Common Seal.—This seal occurs sparingly on all parts of the coast, but it is not seen every year, and in fact the seals that have been taken on the Essex shores can

only be considered as stragglers. It has been killed in the Blackwater, in the mouth of the Thames, and elsewhere; but one great difficulty and source of error in consulting records of the capture of Phocidæ is that one can rarely be certain of the species, in consequence of the specimens having seldom been examined by competent naturalists.

Cystophora cristata. Hooded Seal.—In 1847 a specimen of this seal was taken in the Orwell, and is now preserved in the Ipswich Museum. As the Orwell empties into Harwich harbour I think we are entitled to place this animal in our Essex fauna, although its normal habitat is within the Arctic circle. The above two species are the only seals that I am able to give as visiting the Essex coast without any doubt, but I do not see why the Grey Seal (*Halichærus gryphus*) should not occur, as one of its breeding-stations, the Farne Islands, is on the Northumberland coast; it is a common species in the Hebrides and Shetland, and has been taken in the Isle of Wight.

Rodentia. Sciuridæ.

Sciurus vulgaris. Common Squirrel.—This elegant and active little animal is so well known that very little need be said about it. It occurs in all parts of the county in suitable spots—that is, where there are woods. It is almost omnivorous in its tastes; birds' eggs and insects are occasionally eaten, but vegetables are its main support. In the early spring, when the beech is coming into leaf, I have noticed as many as six squirrels busily feeding in one tree on the young shoots, biting off and throwing down the leaves, and only consuming the stalk—that is, the young branch. In the autumn I have seen squirrels strip off the loose bark from dead branches, and carefully scrape out with their teeth the fungus frequently found in such situations. Whenever I have seen this going on I have noticed the position adopted for feeding is not the usual one; instead of sitting on its haunches, the squirrel almost invariably hangs head downwards. It is said to hybernate, but I much question whether it does so as a rule. It may occasionally take a prolonged sleep, but

I never knew the weather so cold that I could not find a squirrel on the move, if it were properly looked for.

Rodentia. Myoxidæ.

Myoxus avellanarius. Dormouse.—The Dormouse occurs in those parts of Essex where oaks and nuts flourish, and where there is sufficient woodland or overgrown hedges to protect it. It was formerly very common on the roadside at Berechurch, but after the severe winter of 1860 the numbers were greatly diminished. I found many nests in the bushes with dead occupants. This creature is one of the best examples of a hybernating quadruped in this country, and as a rule I think the winter sleep is taken underground, the bush nest not being used for that purpose; at all events in many instances I find them deserted. If the mouse is disturbed in its bush nest, it is extraordinarily quick in its movements amongst the boughs, making a great contrast to the apparently stupid sluggish creature one usually sees in confinement. The food of Dormice is very similar to that of squirrels, but I have occasionally taken them devouring the "sugar" I had placed on tree trunks for the purpose of attracting moths at night.

Rodentia. Muridæ.

Mus minutus. Harvest Mouse.—This very beautiful and active little creature occurs in all parts of Essex, in the winter time being found in corn-stacks, especially those placed in the fields, and I think most frequently in oat-ricks. I never discovered more than a dozen in one rick, although others have informed me that they have been found abundantly in such situations. As a pet it is very interesting, and rarely quiet day or night. They are very peaceable all through the winter, and any number may be kept together, but in the spring fighting goes on until all, or nearly all, the males are destroyed and eaten, for they are dreadful cannibals. But on the whole I can strongly recommend them as pets; they are sweet, not at all mousy in odour, and very amusing in their ways. The longest time I have had them in con-

finement is over two years, but I never could make them so tame as my pets of the next species (*Mus sylvaticus*). In-doors they do not become torpid, nor when living in corn-ricks. I have never found any young in corn-ricks, although they are said to breed there, and I consider their breeding-season is entirely confined to the summer months. This habit perhaps helps to prevent them becoming the pests some of the other mice undoubtedly are to the farmer and gardener.[5]

Mus sylvaticus. Wood Mouse.—This gentle little creature and delightful home pet is one of the most destructive of its race; in fields, gardens, or plantations, newly sown peas or corn, or recently planted bulbs or shrubs, are especial objects of its attention. It is rarely found in houses, barns, or ricks, preferring much the shelter of a hedgerow or wood. I generally have some of these mice in confinement, and they are very friendly one with the other, so that as many as you please may be kept together, even if they are quite strangers. This herding together seems natural to the Wood Mouse, fourteen or fifteen, and even more, may sometimes be dug out of one burrow. They seem also to work together in storing provisions, the bunches of growing barley or other corn showing plainly where the storehouse has been; but nothing in the way of vegetable food seems to come amiss to this very abundant mouse. Albinos are occasionally taken, and the colour of different specimens varies considerably in shades of red. Of all our native mice this is most easily tamed; an occasional specimen is more than usually friendly, and may be made to come into the hand within a month of capture. I have never succeeded in rearing the young of either this or the harvest mouse in confinement.

[5] [This little animal, with the exception of *Sorex pygmæus*, the smallest British mammal, was first noticed as an inhabitant of this country by Gilbert White (Letters X. and XII.) He gave Pennant a description of the tiny nest in his own inimitable style, and adds, "This wonderful procreant cradle, an elegant instance of the efforts of instinct, was found in a wheat-field suspended in the head of a thistle."—Ed.]

Mus musculus. Common Mouse.—Who does not know this foul-smelling, but nevertheless pretty little beast? It abounds everywhere, and has followed man to all parts of the world. Houses, buildings, and corn-ricks are its favourite haunts, and it does not occur in this country except in their vicinity. Its original home certainly was not in Britain.

Mus rattus. Black Rat.—This, our oldest rat, was abundant before the advent of the Brown Rat, called by Walton and others the "Hanoverian." It is now almost extinct, but still occurs about the docks and East End of London. These may not be native examples, and probably the race is kept up by escapes from the vessels in the docks in the neighbourhood. The Black Rat is easily known from the Hanoverian Rat by the slenderness and length of the tail, and by the mouth appearing to be so far under the nose. In habits and feeding there is much in common between the two species, but *Mus rattus* in buildings confines itself to the upper parts and roof, and *Mus decumanus* to the basements and drains.

Mus decumanus. Hanoverian or Norway Rat.—This pest, although placed amongst our native animals, did not make its appearance in England until the earlier part of the eighteenth century, doubtless brought hither by means of merchant vessels from some southern country. Pennant says from the East Indies,[6] and he remarks with prophetical intuition, "It has quite extirpated the common kind (*Mus rattus*) wherever it has taken up its residence; and it is to be feared that we shall scarcely find any benefit by the change —the Norway rat having the same disposition, with greater abilities for doing mischief than the common kind." At the time when the name "Norway Rat" was applied to it, it was not known in Norway at all. It was called the "Hanoverian

[6] ["I suspect that this rat came in ships originally from the East Indies; a large brown species being found there called *Bandicotes*, which burrows underground. Barbot (Churchill's Coll. Voy. 214) also mentions a species inhabiting the fields in Guinea, and probably the same with this." Pennant, 'British Zoology,' i. 117, (4th Edition, 1776.)—Ed.]

Rat" from its having arrived in this country about the same time as the Hanoverian Sovereign; no doubt this was a witticism of our Jacobin fellow-countrymen. Its fecundity, cunning, and omnivorous habits enable it to defy all efforts made to extirpate it, and the destruction wrought by game-preservers on so-called vermin, by getting rid of its natural enemies, is a great help to its continuous abundance in many districts. In the light soils of this neighbourhood (Colchester) every hedge has its colony, especially where game-preserving is carried out. There are few animals that fight more desperately for life when driven into a corner; all fear seems entirely to have forsaken the unfortunate beast, which appears determined to sell its life as dearly as possible, and few of its natural enemies will attack the Hanoverian Rat under these circumstances. I never saw cats even attempt it, they preferring to seize the rat whilst running; and almost every cat has its own peculiar method of doing so. One I remember, always with her foot turned the rat over on its back, caught it by the throat, and at the same time fell on her side and gave one violent kick; the result was immediate death to the unfortunate rat. Other cats throw them over their heads after having bitten them through the heart, and others again simply hold them in their mouths until the rats are dead. But in what way soever the cat seizes them she always takes care to avoid their formidable incisor teeth, and at the same time drives her canines into some vital spot. The town rat is very cautious and most difficult to trap, and his country cousin quickly takes warning after a few have been caught, and most adroitly avoids all snares and gins in the future.

Rodentia. Arvicolidæ.

Arvicola amphibius. Water Rat.—Bell, quoting Waterhouse, says, "The animals comprising this family (Arvicolidæ) have all the essential characters of the Muridæ, but differ in having rootless molars and in the form of the lower jaw." There are other characters given, but rootless molars seem

the great and easily distinguishing feature separating Muridæ and Arvicolidæ. The Water Rat, for its size and numbers, does less damage to man than any other member of the family, its principal food being aquatic vegetables, and it only takes what man can well spare. Occasionally, when they are abundant and the weather is severe, they do a little mischief to osier beds, but the injury they inflict on the farmer is so small as not to be worth consideration. The little animal is common in all parts of Essex, wherever there are sluggish streams or stagnant water in sufficient quantity to hide it. It will be well to bear in mind that it is sometimes quite black in colour, and has been described (by Macgillivray, 'Nat. Lib.' xvii. 257) under the name of *Arvicola ater*, but this is merely a variety. This dark variety has occasionally been mistaken for the old English Black Rat (*Mus rattus*), and many of the supposed appearances of the latter animal can thus be explained.

Arvicola agrestis. Common Field Vole.—Bell says that *A. agrestis* may always be distinguished by the character of its second upper molar, which has five cemental spaces, whereas the same tooth in *A. arvalis* (which has not yet been found in Britain), as in all the other European voles, presents four spaces. This vole abounds sometimes to such an extent as entirely to destroy the herbage, and from the quantity it consumes (in confinement I have known one eat six drachms of clover in twenty-four hours) one can quite understand the devastation caused by it when existing in numbers. Not only is herbage eaten, but, according to Bell, "many years since the plantations of young oaks in New and Dean Forests were destroyed." Its insatiable appetite compels it to be abroad at all seasons of the year and all hours of the day, but I have noticed those I have kept in confinement to be more active towards and during the evening. I never could make them very tame, and they appeared to me to be rather stupid. The nest is usually placed amongst the roots of the grass, sometimes under fallen timber. The young are from four to six in number, and there are generally three or four broods in a year. Weasels, owls, and kestrels are their

greatest enemies, the Short-eared Owl (*Otus brachyotos*) being a great destroyer of them.[7]

Arvicola glareolus. Red Field Vole or Bank Vole.—This vole is by no means common in Essex, according to my experience, although the first recorded specimen as British was described by Yarrell from an Essex example ('Proc. Zool. Soc.' 1832). I have seen a specimen from West Bergholt and another from Layer-de-la-Hay, and I daresay more might be found if observers would carefully examine those voles they meet with. The habits of *A. glareolus* appear to be similar to *A. agrestis*, but I think they are never found in such damp situations as the Field Vole. The only character to be entirely depended on to distinguish them is in the teeth. Colour, length of tail, and brush at the end of tail are uncertain marks in such a variable family, so that I would advise no one to trust any of these singly in the identification of specimens.

Rodentia. Leporidæ.

Lepus timidus. Common Hare.—I shall say little about this animal, as it must be so well known to everyone. It occurs in all parts of the county, and is, from its manner of feeding, a great pest to the corn-grower and gardener. Hares vary much in weight: in this county from seven pounds to

[7] [A passage occurs in the last edition of Yarrell's 'British Birds' which illustrates these observations of Mr. Laver. Speaking of the Short-eared Owl, the author remarks (Vol. i., 165):—"But undoubtedly field-mice, and especially those of the short-tailed group, or voles, are its chief objects of prey, and when these animals increase in an extraordinary and unaccountable way, as they sometimes do, so as to become extremely mischievous, owls, particularly of this species, flock to devour them. Thus there are records of "a sore plague of strange mice" in Kent and Essex in the year 1580 or 1581, and again in the county last mentioned in 1648. In 1754 the same thing is said to have occurred in Hilgay, near Downham Market, in Norfolk, while within the present century the Forest of Dean, in Gloucestershire, and some parts of Scotland, have been similarly infested. In all these cases owls are mentioned as thronging to the spot and rendering the greatest service in extirpating the pests." 'History of British Birds,' by William Yarrell. 4th Edition. London, 1872.—Ed.]

eight pounds is the average, but I once saw a female turn the scale at ten pounds and a half.

Lepus cuniculus. The Rabbit.—This destructive creature is very common in all parts of Essex, and requires little to be said about it; its food, habits, and appearance being familiar to all dwellers in the country. But it may not be so well known that occasionally specimens occur which in colour are quite black, and this without, as I believe, any admixture of tame blood.

Ruminantia. Cervidæ.

Cervus elephas. Red Deer or Stag.—I fear this beautiful animal must be considered extinct in this county, unless there should be a lingerer in Epping Forest, where Bell in his 'British Quadrupeds' says a few were found down to the present century.[8]

Cervus dama. Fallow Deer.—This animal was very early introduced into Britain, of which it is not therefore a true native; but as it exists in many parks in this county in a semi-domesticated condition, I have thought fit to introduce it into the list of our fauna. I see occasional mention of deer in Epping Forest; this species is the one probably meant. It is to be hoped that the managers of this lovely haunt of the Londoners will take steps to protect the few there, and so add to the attractions of the woods.[9]

Cetacea.

The order Cetacea is one of the most difficult divisions of Mammalia for practical study, especially for naturalists who

[8] [Red Deer existed in Epping Forest as late as the year 1827. See 'Proceedings,' i. xlvii.—Ed.]

[9] [The Fallow Deer still lives in the Forest in a wild state in very con-considerable numbers, and the specimens exhibit abnormal characters, perhaps the result of long isolation and inter-breeding. Mr. Harting is studying the subject, and he has promised to bring it before the Club at no very distant date.—Ed.]

are not able to make excursions to those seas where the different forms are most common. The discrimination of species is rendered additionally puzzling in consequence of each author on the subject adopting a classification and nomenclature of his own, or at all events giving names to varieties which other students may consider to belong to the typical species. In the foregoing orders of Mammalia I have been able to give the results of my own observations, but here, of course, I must depend on records only, and shall claim as belonging to our Essex fauna any cetaceans taken in our rivers or on our coasts. Many of these records are quite useless from the want of a correct description of the animal. The terms "Bottle-nose," "Fin-back," and so on, being evidently often very loosely and inaccurately applied, and of no assistance in identifying the true name of the captures, I have been obliged to pass over many observations from inability to recognise the species recorded. As might be expected from its size, the River Thames appears to have been very productive in species, and the records are the more valuable as the species have generally been identified by competent naturalists, as a result of the ease of access to London.

MYSTACOCETI. BALÆNOPTERIDÆ.

BALÆNOPTERA MUSCULUS. The Rorqual.—This whale, one of the largest animals, has occurred on our coasts several times. One was taken in the Thames in May, 1859; and in the 'Zoologist' for 1849, p. 2620, is recorded the capture of a "finner whale" at Grays, of the length of 58 feet, and a girth of 30 feet: judging by these dimensions it was probably an example of this species.

B. ROSTRATA. Lesser Rorqual.—This is one of the best marked and most easily distinguished species of the family, and at the same time one of the most common on our coasts. It has occurred in the Thames several times, John Hunter describing, in the 'Philosophical Transactions' for 1787, one from this river; another was also recorded and figured in the 'Zoologist' for 1843, p. 33, and is now preserved in the British Museum.

Odontoceti. Physeteridæ.

Physeter macrocephalus. Sperm Whale.—This tropical whale has occasionally wandered to the shores of this island; and it is recorded that in 1788 six were found dead on the Kentish coast, and a live one ran ashore in the Thames at the same time. Dale also mentions one caught in the Thames, and brought ashore at Blackwall.

Hyperoodon rostratus. Common Beaked Whale.—This is the best known species of the family of ziphioid whales, which are distinguished by possessing one or two pairs of teeth, situated in the lower jaw only. It appears to come into British waters regularly in the autumn, and specimens are killed almost every year on some parts of the coasts of this island. John Hunter records one captured in the Thames above London Bridge in 1783; and another, no doubt of this species, is figured in Dale's 'History of Harwich and Dovercourt,' as having been captured in the Blackwater estuary.

Odontoceti. Delphinidæ.

Orca gladiator. Grampus.—John Hunter records the capture of three specimens of this savage and destructive animal in the River Thames towards the end of the last century; and in the British Museum is the skull of a specimen taken on the Essex coast, as recorded in the 'Zoologist' for 1873, p. 3429. Some years since I saw two whales, which had been killed in one of the creeks of the Blackwater, which I have no doubt were of this species, but no record was kept of them, and I do not recollect what became of their bones; probably, as usual, they went for manure.

Phocæna communis. Porpoise.—Who does not know this merry and active creature? It occurs everywhere on our coasts, and is as frequently seen during stormy weather as at any other time, apparently revelling in the tempestuous waters. It is so common that I have not thought it necessary to give any records of capture.

Delphinus delphis. Common Dophin.—I have not been able to find a record of the occurrence of this common

cetacean on any part of our Essex coast; but I feel certain that it ought to be in our list. Perhaps someone with better opportunities than myself will be able to give an instance of its capture.

D. TURSIO. Bottle-nosed Dolphin.—This generally reputed rare animal has occurred twice within my own observation. One occurred a few years since off Harwich, the specimen being about 10 feet long; and the other was shot in the Colne a few months since, as I recorded in the 'Zoologist' for 1882, p. 147. This specimen, like the last, was a female, and was about 8 feet long. In 1829 one was taken in the Thames below the Nore, and its skeleton is in the museum of the College of Surgeons. In most of the drawings of the skull of this animal the teeth are represented as truncated; this is no doubt the result of wear, and is incidental to age; but in both those individuals examined by me the teeth were sharp, and slighly directed inwards and backwards. The stomachs, in both cases, were empty, except that they contained a large number of the ear-bones (otoliths) of the Gadidæ: I recognised those of cod, haddock, and whiting. I fancy this is one of the most easy to kill of the family; I have known one caught by a cod-hook in the lip and killed; and the one in the Colne succumbed to a charge of small shot.

From the above list it will be seen that I claim for Essex a total of forty mammals, besides the three doubtful ones,—the common marten (*Mustela foina*), grey seal (*Halichærus gryphus*), and red deer (*Cervus elephas*). There are probably some other members of the order Cetacea which ought to be included in this Catalogue.

Those I have mentioned belong to the following orders:—

CHEIROPTERA	7	species.
INSECTIVORA	5	,,
CARNIVORA	8	,,
RODENTIA	12	,,
RUMINANTIA	1	,,
CETACEA	7	,,
	40	,,

I have had no opportunity for comparing a list of the Faunas of the adjoining counties, excepting that of Norfolk, by the Rev. Richard Lubbock, published in 1845, and he records only thirty-four mammals; but the authors of the last edition of Bell's 'British Quadrupeds' describe a total of seventy-three as occurring in the British Islands. Considering the cultivated and enclosed condition of many parts of Essex, I think the catalogue of forty mammals compares very well with the list for the whole of Britain, especially when we remember that several cetaceans and seals are in all probability only absent by reason of deficient observation, and may be eventually recorded as members of the Essex Fauna when more attention is paid to the scientific study of our Mammalia.

XV. A Preliminary List of the Hymenomycetal Fungi of Epping Forest; A Contribution to the Botany of the County.

By M. C. Cooke, M.A., LL.D., A.L.S., &c., and James L. English.

[Read November 26th and December 17th, 1881.]

[This list of the Fungi of the family Hymenomycetes, occurring within the Forest Districts, is intended only as a prodromus of the more extended and exhaustive catalogue to which we may look forward as the result of the persevering labours of our botanical members and others. It enumerates all the species of the family (338 in number) yet identified with certainty as growing within the prescribed district, which lies on both sides of the line separating Provinces I. and II. of Professor Boulger's sketch map of the County (Plate VI.). The list has been compiled by Dr. Cooke ["C."] from his notes of personal visits to the Forest, and from materials furnished as the result of many years' observation by Mr. English, of Epping ["E."], with the addition of a few species noted by Mr. Worthington G. Smith. The indication of precise localities is purposely avoided, as being almost useless; fungi are very capricious and evanescent in their places of growth, slight local changes often resulting in the appearance of species in new stations, or in the destruction of old and well-known habitats. The word "Epping" appended to Mr. English's records must be taken with rather a wide interpretation: it includes the woods near the town of that name, with Monk Woods, Theydon Woods, &c.,—in short, the northern section of Epping Forest.

The list will doubtless be considerably extended as the Cryptogamic flora of Essex is more thoroughly investigated; but it is thought best to print it as it stands, to serve as an indication of the riches of the Forest, and as a guide to

visitors at our "Fungus Forays." Supplemental lists will be published from time to time as materials accumulate, and authenticated records of new gatherings will always be gladly received by the Editor for that purpose.

Most of the species mentioned are described in Dr. Cooke's 'Handbook of British Fungi' (1871) or in the volumes of 'Grevillea' (1872 *et seq.*), and coloured figures of many are given in the latter periodical and in Cooke's 'Illustrations of British Fungi' now in course of publication.—Ed.]

Agaricus (Amanita) Phalloides, Fr. Common (C.)
,, Mappa, Fr. Epping (E.)
,, vernus, Fr. Highbeach (C.)
,, muscarius, Fr. Monks Wood (C.)
,, pantherinus, Fr. Highbeach (C.)
,, excelsus, Fr. Monks Wood (C.)
,, rubescens, Fr. Common (C.)
,, vaginatus, Fr. Common (C.)
,, strangulatus, Fr. (W. G. Smith.)
Agaricus (Lepiota) procerus, Fr. Loughton (C.)
,, rhacodes, Fr. Epping (E.)
,, excoriatus, Schæff. Epping (E.)
,, acutesquamosus, Wm. Epping (E.)
,, cristatus, Fr. Epping (E.)
,, granulosus, Fr. Common (C.)
Agaricus (Armillaria) melleus, Fr. Common (C.)
,, mucidus, Fr. Highbeach (C.)
Agaricus (Tricholoma) sejunctus, Sow. Highbeach (C.)
,, gambosus, Fr. Epping (E.)
,, nictitans, Fr. (W. G. Smith.)
,, grammopodius, Bull. Epping (E.)
,, fulvellus, Fr. (W. G. Smith.)
,, acerbus, Fr. Epping (E.)
,, ustalis, Fr. Monks Wood (C.)
,, Columbetta, Fr. Epping (E.)
,, civilis, Fr. Epping (C.)
,, vaccinus, Fr. Epping (E.)
,, flavobrunneus, Fr. Monks Wood (C.)

AGARICUS (TRICHOLOMA) ALBOBRUNNEUS, Fr. Epping (E.)
,, TERREUS, Fr. Epping, &c. (C.)
,, RUTILANS, Schæff. Epping (E.)
,, SAPONACEUS, Fr. Monks Wood (C.)
,, CARNEUS, Fr. Epping (E.)
,, RESPLENDENS, Fr. Epping (E.)
,, IMBRICATUS, Fr. Epping (E.)
,, PERSONATUS, Fr. Epping (E.)
,, NUDUS, Fr. Loughton (C.)
,, SUBPULVERULENTUS, Fr. Epping (E.)
AGARICUS (CLITOCYBE) INFUNDIBULIFORMIS, Fr. Common (C.)
,, CYATHIFORMIS, Fr. Epping (E.)
,, FLACCIDUS, Sow. Highbeach (C.)
,, NEBULARIS, Fr. Epping (E.)
,, ERICETORUM, Fr. Loughton (C.)
,, MAXIMUS, Fr. Epping (E.)
,, FUMOSUS, Fr. Epping (E.)
,, DEALBATUS, Fr. Epping (E.)
,, BRUMALIS, Fr. Highbeach (C.)
,, METACHROUS, Fr. Epping (E.)
,, BELLUS, Fr. Loughton (C.)
,, ODORUS, Fr. Epping (E.)
,, LACCATUS, Fr. Common (C.)
,, PHYLLOPHILUS, Fr. Epping (E.)
,, ELIXUS, Sow. Epping (C.)
AGARICUS (COLLYBIA) RADICATUS, Fr. Common (C.)
,, VELUTIPES, Fr. Highbeach (C.)
,, FUSIPES, Bull. Loughton (C.)
,, MACULATUS, Fr. Highbeach (C.)
,, BUTYRACEUS, Fr. Monks Wood (C.)
,, CIRRHATUS, Schum. Loughton (C.)
,, TUBEROSUS, Bull. Monks Wood (C.)
,, MUSCIGENUS, Fr. Highbeach (C.)
,, DRYOPHILUS, Bull. Loughton (C.)
AGARICUS (MYCENA) PURUS, P. Loughton (C.)
,, GALERICULATUS, Scop. Common (C.)
,, POLYGRAMMUS, Bull. Loughton (C.)
,, LACTEUS, Pers. Epping (E.)

Agaricus (Mycena) elegans, Fr. Loughton (C.)
,, alcalinus, Fr. Loughton (C.)
,, galopus, Fr. Epping (E.)
,, epipterygius, Scop. Loughton (C.)
Agaricus (Omphalia) Fibula, Fr. Loughton (C.)
,, pyxidatus, Bull. Epping (E.)
Agaricus (Pleurotus) spongiosus, Fr. Epping (C.)
,, dryinus, Fr. Epping (E.)
,, ostreatus, Fr. Epping (E.)
,, petaloides, Bull. Epping (E.)
,, chioneus, Pers. Epping (E.)
Agaricus (Annularia) cretaceus, Ph. Epping (E.)
Agaricus (Pluteus) cervinus, Fr. Loughton (C.)
,, umbrosus, Fr. Epping (E.)
Agaricus (Entoloma) prunuloides, Fr. Monks Wood (C.)
,, rhodopolius, Fr. Epping (E.)
,, sinuatus, Fr. Loughton (C.)
,, sericeus, Fr. Highbeach (C.)
,, griseo-cyaneus, Fr. Epping (E.)
,, nidorosus, Fr. Monks Wood (C.)
Agaricus (Clitopilus) prunulus, Fr. Epping (C.)
,, orcella, Fr. Epping (E.)
Agaricus (Nolanea) pascuus, Fr. Loughton (C.)
,, pisciodorus, Fr. Epping (E.)
Agaricus (Claudopus) variabilis, Fr. Loughton (C.)
,, euosmus, Fr. Epping (E.)
Agaricus (Pholiota) squarrosus, Fr. Epping (C.)
,, radicosus, Bull. Epping (E.)
,, adiposus, Fr. Epping (E.)
,, spectabilis, Fr. Epping (E.)
,, mutabilis, Schæff. Epping (E.)
Agaricus (Inocybe) geophyllus, Fr. Common (C.)
,, rimosus, Bull. Epping (E.)
,, pyriodorus, Pers. Epping (E.)
Agaricus (Hebeloma) fastibilis, Fr. Epping (E.)
Agaricus (Flammula) decipiens, Sm. Epping (C.)
,, spumosus, Fr. Epping (C.)
,, gummosus, Fr. Epping (E.)

Agaricus (Flammula) carbonarius, Fr. Epping (E.)
,, alnicola, Fr. Epping (C.)
,, hybridus, Fr. Epping (C,)
Agaricus (Naucoria) semiorbicularis, Bull. Loughton (C.)
,, melinoides, Bull. Highbeach (C.)
Agaricus (Galera) tener, Schæff. Common (C.)
,, ovalis, Fr. Highbeach (C.)
,, hypnorum, Batsch. Loughton (C.)
Agaricus (Tubaria) furfuraceus, P. Epping (E.)
Agaricus (Psalliota) campestris, L. Epping (C.)
,, pratensis, Schæff. Epping (E.)
,, inunctus, Fr. Epping (C.)
Agaricus (Stropharia) æruginosus, Curt. Loughton (C.)
,, Worthingtonii, Fr. Highbeach, Epping (C.)
,, obturatus, Fr. Epping (E.)
,, squamosus, Fr. Loughton (C.)
,, semiglobatus, Batsch. Common (C.)
Agaricus (Hypholoma) sublateritius, Schæff. Common (C.)
,, fascicularis, Huds. Common (C.)
,, udus, P. Loughton (C.)
,, storea, Fr. Epping (C.)
,, lacrymabundus, Fr. Loughton (C.)
,, appendiculatus, Fr. Loughton (C.)
Agaricus (Psilocybe) ericæus, P. Loughton (C.)
,, semilanceatus, Fr. Common (C.)
,, spadiceus, Fr. Common (C.)
,, Fœnisecii, Fr. Common (C.)
Agaricus (Psathyra) conopileus, Fr. Loughton (C.)
Agaricus (Panæolus) separatus, Fr. Monks Wood (C.)
,, fimiputris, Fr. Loughton (C.)
,, retirugis, Fr. Loughton (C.)
,, campanulatus, Fr. Loughton (C.)
,, sphinctrinus, Fr. Monks Wood (C.)
Agaricus (Psathyrella) disseminatus, Fr. Loughton (C.)
Coprinus atramentarius, Fr. Loughton (C.)
,, comatus, Fr. Epping (E.)
,, ovatus, Fr. Epping (E.)

Coprinus niveus, Fr. Common (C.)
,, micaceus, Fr. Common (C.)
,, deliquescens, Fr. Epping (E.)
,, picaceus, Fr. Hainault Forest (C.)
,, aratus, B. & Br. Monks Wood (C.)
,, plicatilis, Fr. Epping (E.)
,, radiatus, Fr. Loughton (C.)
Cortinarius (Phleg.) largus, Fr. Loughton (C.)
,, purpurascens, Fr. Highbeach (C.)
,, decoloratus, Fr. Epping (C,)
,, glaucopus, Fr. Highbeach (C.)
Cortinarius (Myx) elatior, Fr. Common (C.)
,, Riederi, Fr. Loughton (C.)
,, collinitus, Fr. Epping (E.)
Cortinarius (Ino) alboviolascens, Fr. Highbeach (C.)
,, violaceus, Fr. Epping (E.)
,, bolaris, Fr. Epping (E.)
Cortinarius (Derm.) ochroleucus, Fr. High Beach (C.)
,, tabularis, Fr. Epping (E.)
,, orellanus, Fr. Epping (E.)
,, anomalus, Fr. Epping (E.)
,, decumbens, Fr. Epping (C.)
,, sanguineus, Fr. Epping (E.)
,, cinnabarinus, Fr. Monks Wood (C.)
,, cinnamomeus, Fr. Monks Wood (C.)
Cortinarius (Telam.) hinnuleus, Fr. Epping (E.)
Cortinarius (Hyd.) decipiens, Fr. Loughton (C.)
,, rigens, Fr. Epping (E.)
Paxillus involutus, Fr. Common (C.)
Hygrophorus eburneus, Fr. Highbeach (C.)
,, cossus, Fr. Monks Wood (C.)
,, lætus, Fr. (*Houghtoni*, B.) Loughton (C.)
,, pratensis, Fr. Epping (E.)
,, virgineus, Fr. Epping (E.)
,, Colemannianus, Blox. Epping (E.)
,, ceraceus, Fr. Epping (E.)
,, coccineus, Fr. Epping (E.)
,, conicus, Fr. Epping (E.)

Hygrophorus psittacinus, Fr. Epping (E.)
,, chrysodon, Fr. Monks Wood (C.)
,, miniatus, Fr. Monks Wood (C.)
Gomphidius glutinosus, Fr. Epping (E.)
Lactarius blennius, Fr. Monks Wood (C.)
,, torminosus, Fr. Epping (E.)
,, turpis, Fr. Epping (E.)
,, controversus, Fr. Epping (E.)
,, trivialis, Fr. Epping (E.)
,, pyrogalus, Fr. Epping (E.)
,, chrysorrhœus, Fr. Epping (E.)
,, deliciosus, Fr. Epping (E.)
,, insulsus, Fr. Epping (E.)
,, glyciosmus, Fr. Epping (E.)
,, fuliginosus, Fr. Epping (E.)
,, volemum, Fr. Epping (E.)
,, camphoratus, Fr. Epping (E.)
,, quietus, Fr. Monks Wood (C.)
,, piperatus, Fr. Loughton (C.)
,, vellereus, Fr. Loughton (C.)
,, pallidus, Fr. Monks Wood (C.)
,, rufus, Fr. Loughton (C.)
,, mitissimus, Fr. Loughton (C.)
,, subdulcis, Fr. Loughton (C.)
,, serifluus, Fr. Loughton (C.)
Russula nigricans, Fr. Common (C.)
,, adusta, Fr. Loughton (C.)
,, furcata, Fr. Loughton (C.)
,, rosacea, Fr. Epping (E.)
,, virescens, Fr. Epping (C.)
,, fœtens, Fr. Epping (C.)
,, ochroleuca, Fr. Monks Wood (C.)
,, lepida, Fr. Epping (E.)
,, depallens, Fr. Monks Wood (C.)
,, fellea, Fr. Highbeach (C.)
,, integra, Fr. Monks Wood (C.)
,, alutacea, Fr. Epping (E.)
,, cyanoxantha, Fr. Loughton (C.)

Russula heterophylla, Fr. Loughton (C.)
,, emetica, Fr. Loughton (C.)
,, decolorans, Fr. Epping (E.)
,, fragilis, Fr. Common (C.)
,, citrina, Gillet. Common (C.)
,, lutea, Fr. Highbeach (C.)
,, cutefracta, Cooke. Loughton (C.)
Cantharellus cibarius, Fr. Loughton (C.)
,, aurantiacus, Fr. Loughton (C.)
,, tubæformis, Fr. Loughton (C.)
Nyctalis parasitica, Fr. Loughton (C.)
,, asterophora, Fr. Epping (E.)
Marasmius peronatus, Fr. Loughton (C.)
,, urens, Fr. Epping (E.)
,, ramealis, Fr. Loughton (C.)
,, oreades, Fr. Epping (E.)
,, rotula, Fr. Loughton (C.)
,, Hudsoni, Fr. Wanstead (C.)
,, fusco-purpureus, Fr. Epping (E.)
,, androsaceus, Fr. Loughton (C.)
,, epiphyllus, Fr. Loughton (C.)
Lentinus lepideus, Fr. Epping (E.)
,, cochleatus, Fr. Epping (E.)
Panus stypticus, Fr. Loughton (C.)
,, torulosus, Fr. Epping (E.)
Lenzites betulina, Fr. Common (C.)
Boletus elegans, Schum. Loughton (C.)
,, flavus, Fr. Epping (E.)
,, chrysenteron, Fr. Loughton (C.)
,, subtomentosus, Fr. Epping (C.)
,, bovinus, Fr. Epping (E.)
,, piperatus, Fr. Epping, Hainhault Forest (C.)
,, pachypus, Fr. Epping (C.)
,, rubinus, Sm. Epping (E.)
,, edulis, Fr. Highbeach (C.)
,, scaber, Fr. Highbeach (C.)
,, æstivalis, Fr. Epping (E.)
,, luridus, Fr. Highbeach (C.)

Boletus satanas, Fr. Epping (E.)
,, erythropus, Fr. Monks Wood (C.)
,, calopus, Fr. Epping (C.)
Fistulina hepatica, Fr. Epping (C.)
Polyporus Schweinitzii, Fr. Epping (E.)
,, rufescens, Fr. Epping (E.)
,, perennis, L. Epping (E.)
,, squamosus, Huds. Epping (C.)
,, picipes, Fr. Epping (E.)
,, varius, Fr. Epping (C.)
,, elegans, Fr. Epping (E.)
,, lucidus, Fr. Epping (E.)
,, intybaceus, Fr. Epping (E.)
,, giganteus, Fr. Epping (E.)
,, sulphureus, Fr. Epping (E.)
,, imbricatus, Bull. Epping (E.)
,, adustus, Fr. Loughton (C.)
,, cæsius, Fr. Hainault Forest (C.)
,, adiposus, B. & Br. Epping (E.)
,, hispidus, Fr. Epping (E.)
,, cuticularis, Fr. Epping (E.)
,, dryadeus, Fr. Epping (E.)
,, betulinus, Bull. Epping (E.)
,, fomentarius, Fr. Epping (E.)
,, igniarius, Fr. Epping (E.)
,, annosus, Fr. Loughton (C.)
,, versicolor, L. Common (C.)
,, vaporarius, Fr. Common (C.)
Trametes mollis, Fr. Epping (C.)
,, gibbosa, Fr, Epping (E.)
Dædalea quercina, Fr. Epping (C.)
,, confragosa, Fr. Highbeach (C.)
,, unicolor, Fr. Epping (C.)
Merulius corium, Fr. Epping (C.)
,, tremellosus, Fr. Epping (E.)
Hydnum repandum, Fr. Epping (C.)
,, erinaceum, Fr. Epping (E.)
,, zonatum, Fr. Epping (E.)

Hydnum ferruginosum, Fr. Epping (E.)
,, cirrhatum, Fr. Epping (C.)
Sistotrema confluens, Fr. Epping (E.)
Radulum fagineum, Fr. Epping (C.)
,, quercinum, Fr. Epping (C.)
Craterellus cornucopiodes, Fr. Loughton (C.)
,, crispus. Highbeach (C.)
Thelephora caryophyllæa, Fr. Loughton (C.)
,, clavularis, Fr. Epping (E.)
,, anthocephala, Fr. Hainault Forest (C.)
,, laciniata, P. Loughton (C.)
,, multizonata, Berk. Epping (C.)
,, cristata, Fr. Epping (E.)
,, crustacea, Schum. Epping (C.)
Stereum hirsutum, Fr. Common (C.)
,, spadiceum, Fr. Epping (E.)
,, purpureum, Fr. Highbeach (C.)
,, rugosum, Fr. Epping (E.)
,, sanguinolentum, Fr. Loughton (C.)
Hymenochæte rubiginosa, Lev. Epping (E.)
,, tabacina, Lev. Epping (E.)
Auricularia mesenterica, Fr. Epping (E.)
Peniophora quercina, Fr. Loughton (E.)
Corticium serum, Fr. Epping (C.)
,, læve, Fr. Common (C.)
,, puteanum, Fr. Epping (C.)
,, sebaceum, Fr. Epping (E.)
,, cellare, P. Epping (C.)
Clavaria flava, Schæff. Monks Wood (C.)
,, fastigiata, Fr. Epping (E.)
,, cinerea, Fr. Epping (E.)
,, cristata, Fr. Epping (E.)
,, aurea, Schæff. Epping (E.)
,, inæqualis, Fr. Epping (E.)
,, vermiculata, Fr. Epping (E.)
,, coralloides, L. Monks Wood (C.)
,, rugosa, Fr. Wanstead (C.)
,, fusiformis, Sow. Epping (C.)

Clavaria pistillaris, L. Monks Wood (C.)
Calocera viscosa, Fr. Epping (E.)
,, cornea, Fr. Epping (E.)
Typhula phacorrhiza, Fr. Walthamstow (C.)
Tremella foliacea, Fr. Epping (C.)
,, mesenterica, Fr. Epping (E.)
Exidia glandulosa, Fr. Loughton (C.)

The above list includes the species enumerated by Sowerby as having been found in this neighbourhood. In many genera the enumeration is known to be very imperfect, but this may be accounted for by the fact that until recently no definite record was kept, and only well ascertained species have been inserted under the impression that accuracy is preferable, even though it is secured by brevity. A first catalogue is usually an imperfect one, since it is limited to the observation of one or two individuals; but, with such a basis, it will not be difficult to extend it year by year, and to ultimately secure a moderately complete catalogue of the larger Fungi of the Forest district. To this end it is hoped that any well-authenticated occurrence of additional species will be communicated to the Secretary.—M. C. C.

XVI. The Presidential Address; Delivered by Raphael Meldola, F.R.A.S., F.C.S., at the Annual Meeting, January 28th, 1882.

Ladies and Gentlemen,

The grateful task of congratulating you upon the completion of another annual cycle once more devolves upon me. Whilst fully sensible of the honour which you have conferred upon me by electing me for the third year to the Presidential Chair, I cannot but rejoice to think that our Society has now assumed such proportions that I may confidently look forward to seeing, at no very distant period, my present position filled by some gentleman having more direct claim to your consideration both as a local resident and a working naturalist. The duty of acting for another year the part of a nurse towards this Club, whose birth and growth I have watched with such interest, will, however, give me even more gratification than heretofore, since our ranks are filling with that class of members whose support we most value, and our publications show that we have commenced work in earnest.

During the past year our Society has had several resignations, and two deaths; but, notwithstanding this, we now number some 314 members as compared with 224 in our last year's list. The deaths we have to deplore are those of Mr. Walter P. Weston and Sir Antonio Brady.

Mr. Weston was well known as a student of our native Lepidoptera and Coleoptera, the Tortrices being his special objects of study. He also added considerably by his labours to our knowledge of the insects inhabiting oak-galls, whilst his activity as a general entomologist is borne witness to by his numerous contributions to the pages of the 'Entomologist.' Our late member died of consumption at a comparatively early age, and although I had not the pleasure of knowing

him personally, his friends were unanimous in testifying to his amiable disposition; and we cannot but express our sorrow at having lost a promising member who, had he been spared, would doubtless have taken an active part in the work of the Club.

At the meeting held on December 17th it was my painful duty to have to announce the death of Sir Antonio Brady; and as it is proposed to publish a special memoir of our deceased member, whose memory is still green among us, I will not at present give any account of his scientific work, but will simply put upon record the deep regret which the removal of this genial elephant-hunter of the Roding Valley has caused to all those who numbered him among their friends, and whose death will be felt most severely by our Club, in which he took such active interest, as well as by the scientific world in general.

The Essex Field Club is now so well launched on its career that I do not propose to dwell at any length upon our past or future work. My appeal to our own members to support us by their scientific contributions has, I am happy to see, borne fruit. During the year we have published three Parts of 'Transactions,' with the 'Journal of Proceedings,' and to these we may, I think, justly point with some pride, as evidence of our activity and as a guarantee of future exertion. Looking back to the line of work as laid down in my Inaugural Address of February 28th, 1880, I cannot but feel gratified to think in how short a period we have commenced to realise the position therein traced out. We have received this year several most valuable contributions to the lists of the County Fauna and Flora, and in the next part of our 'Transactions' we shall have the pleasure of seeing Mr. Henry Laver's lists of the Mammalia and Mollusca, Mr. Fitch's excellent paper upon the Essex Galls, and Dr. M. C. Cooke's list of the Hymenomycetal Fungi of the Loughton District. The papers published during the year are, if I may say so, typical of the class of subjects which our Society claimed at the outset as proper to the studies of a Field Club. Thus in Natural History we have Mr. White's suggestive

query as to the ancestry of *Vanessa Urticæ*, reprinted *in extenso* in the 'Entomologist' for August, 1881; Mr. English's contribution to the history of "sugaring" for moths; and Mr. Saville Kent's admirable sketch of the Infusoria. In the department of Botany our energetic member Prof. Boulger has dealt with the larger problems of the evolution of fruits, and the origin and distribution of the British flora. In Geology we have been the means of giving publicity to Mr. Dalton's paper on the Blackwater Valley—a paper which is to be valued not only on account of its intrinsic interest, but because it has given us an opportunity of justifying an appeal to those officers of H.M. Geological Survey who have worked in our county, to enrich our 'Transactions' with some of their observations.

Our labours in the field of pre-historic Archæology demand more than a passing notice. Interesting "finds" of flint and bronze weapons have been exhibited and described by Mr. Henry Corder. The excavation of the ancient earthwork known as Ambresbury Banks has been so far successful that we are now able to state conclusively that this camp is of British construction. But although we have thus far dispelled the mystery enshrouding one of these Forest Camps, it must not be supposed that our investigations, commenced under such fortunate circumstances, are by any means completed. At least one other section through the Ambresbury earthwork will be desirable in order to obtain, if possible, more definite evidence as to the precise period of its erection, as stated in the report published in the last part of our 'Transactions.' We have further to congratulate ourselves that the exploration of the Loughton camp, which we hope to undertake in the course of the ensuing summer, has been considered a task worthy of recognition by the British Association, that body, at the jubilee meeting held in York, having appointed for this purpose a committee composed of members of our Club. I have no doubt but that the necessary funds will be forthcoming when an appeal is made to our members at large.

My review of this, our first extensive undertaking in the

way of archæological research, would be most seriously incomplete did I fail once more to remind you how much we owe to the skill and generosity of the eminent President of the Anthropological Institute, General Pitt-Rivers, who has not only directed our efforts and drawn up the account which is now in the hands of all our members, but has presented us with the coloured plate which graces Part 5 of our 'Transactions,' and adds so much to the value of the report.

There is no occasion for me to take up much more of your time this evening with other business matters; these have been stated fully in the Council Report, and I have to make a large demand upon your patience when I enter later into the scientific portion of my Address. I may just remark that our Museum has received valuable additions from Mr. William White, Mr. James English, Mr. Henry Cole, and Mr. Harcourt. All our meetings, both field and ordinary, have been remarkably well attended, and we have had the pleasure of joining with the Geologists' Association, with the subscribers to the Chelmsford Museum, and with the Hertfordshire Field Club, in excursions to Grays, Chelmsford, and Epping Forest respectively.

The public lectures which we commenced last session in connection with the Club have been discontinued on account of the great amount of extra work which they threw upon our excellent Hon. Secretary, and because of the insufficient support which we received in the neighbourhood.

Although my time is limited I cannot lightly pass over my obligations to my friend Mr. William Cole, for the zealous and able manner in which he has performed those most arduous duties which he has so generously taken upon himself, and in the execution of which he has so considerably lightened the gratifying and honourable tasks which I have had the pleasure of fulfilling on your behalf during the past year. Nor can we fail to acknowledge the valuable services of our Librarian, Mr. Alfred Lockyer, whose energetic efforts are so apparent in the excellent state of our small but growing library. Our Treasurer, Mr. Henry J. Barnes, had unfortunately to leave us before the expiration of the year,

but his brother, Mr. Richard L. Barnes, has most kindly and efficiently been carrying on his duties for him during his absence.

Summing up the results achieved during the second year of our existence, we have every reason to be satisfied with our position. We may at first have appeared to be aiming rather high in aspiring to the rank of the County Club, but our present list of members shows that we are justified in laying claim to this title. We have mustered our scientific forces farther afield, and we hope during the approaching season to gather fresh strength from the farthermost limits of our County.

As the prosperity of our Club has happily rendered unnecessary anything more than a general sketch of our labours, I have thought it best to establish a precedent for maintaining the activity of the Presidential Chair by offering for your consideration a memoir upon a special biological subject, and to this I will at once proceed without further delay.

[The President then read the first part of an exhaustive essay on "The Phenomena of Cyclical Propagation in the Animal Kingdom." This memoir will be printed as a separate paper in the next volume of the 'Transactions.'—Ed.]

JOURNAL OF PROCEEDINGS

AT

ORDINARY, FIELD, AND OTHER MEETINGS.

SATURDAY, FEBRUARY 26TH, 1881.—ORDINARY MEETING.

[BEFORE the commencement of the official business of the Meeting, the Rev. W. Linton Wilson, M.A. (one of the Vice-Presidents of the Club) in a kindly speech presented the Honorary Secretary with a handsome silver salver and a purse, on behalf of some members of the Club, as a friendly memento of his labours in the foundation and first year's work of the Society. The salver is inscribed as follows:—"Presented to William Cole, Esq., by some of the members of the Epping Forest and County of Essex Naturalists' Field Club, in recognition of his services in connection with that Society, February 26th, 1881." Mr. Cole in a short speech warmly thanked his friends and colleagues for their kindly feelings towards him, and for their generous appreciation of his efforts to found a Naturalists' Society in Essex which should be worthy of their fine but much-neglected county. He had received so much ready help from scientific and other friends that the work of calling the Club into being had been a very delightful task, and he felt that success was certain if equal energy and enthusiasm were shown in the future.]

The thirteenth Ordinary Meeting was held at the head-quarters of the Club, 3, St. John's Terrace, Buckhurst Hill, at seven o'clock, the President, Mr. Raphael Meldola, in the chair.

Letters of thanks for election as HONORARY MEMBERS from Dr. M. C. Cooke, J. E. Harting, Esq., Major-General Pitt-Rivers, Worthington Smith, Esq., and Henry Walker, Esq., were read by the Secretary.

Donations of books, pamphlets and periodicals (exclusive of "Exchanges") were announced from Miss Cole, Mr. B. G. Cole, Mr. P. F. Copland, Mr. W. H. Gomm (15 vols.), Mr. J. E. Harting (9 vols.), Mr. W. S. Simpson, Mr. W. Swanston, Mr. C. Thomas, Rev. F. A. Walker, and Mrs. Yeates. Mr. Heathfield presented one of Smith and Beck's "Universal Microscopes"; Mr. Gomm three exhibition boxes; the Rev. F. A. Walker some specimens of sponges, &c., from Hunstanton; and Mr. Meldola some skins of British birds. A vote of thanks to the donors was passed by acclamation. Upwards of twenty of the principal

Provincial Natural History Societies sent copies of their Transactions in exchange with the Club.

The following were elected members of the Club:—Messrs. C. Black, R. R. Hutchinson, B. Pratt, J. L. Reid, and A. H. Tozer.

The President informed the Meeting that, at the Council held that evening, the following gentlemen had been chosen as a Sub-committee to conduct the exploration of the Ancient Camps in Epping Forest:—The Officers, *ex officio*; Mr. D'Oyley (*Hon. Surveyor*), Mr. Thomas, Mr. Fisher Unwin, Mr. Robarts, and Rev. W. Linton Wilson. The Council requested the names of other members to act on the Committee; and Messrs. H. A. Cole, James English, and F. H. Varley were nominated so to act.

The Secretary exhibited, on behalf of the Rev. F. A. Walker, some specimens of "Petrified Oak" from the stone-quarries, Isle of Portland, and some large pieces of calcareous incrustations, or slabs of stalagmite, caused by the percolation of water over the surface of limestone rocks, and called by the guides "*congealed water*"; also from the Isle of Portland.

Professor Boulger remarked the idea that these slabs of stalagmite were really composed of hardened water was gravely held in many places. In the South of Ireland he had once pointed out some slabs to a limestone-burner, asking him why he did not put them into his kiln, as they would make excellent lime. From the man's replies it was evident he feared that the *congealed water* would put his fires out! (Laughter.)

Sir J. Clarke Jervoise sent up a plan of some earth-works in the Holt Wood, near Horndean, Hants, which he thought would be interesting in connection with the Forest Camps explorations. He also sent some pieces of flint, concerning which he wrote as follows:—"Near the camps in Holt Wood is a circular earth-work with high banks and a ditch; there is a pond in one part, pitched with flints, and on the mound and all about the sides of the pond the ground is strewed with reticulated 'Pot-boiler' flints (see Tylor's 'Early History of Mankind'). I happen to have specimens indoors, which I send. The late Mr. Albert Way gave me credit for being the first to discover the use of these flints, which have been heated and cooled rapidly in the operation of boiling food before earthenware that would stand the fire was discovered. We find them in heaps, generally near water. School-boys call them *milk-stones*. I once found a flint *celt* lying upon a heap of 'pot-boilers.'" *

* "There is European evidence of the art of stone-boiling. . . . . Moreover, the quantities of stones, evidently calcined, which are found buried in our own country, sometlmes in the sites of ancient dwellings, give great probability to the inference which has been drawn from them, that they were used in cooking. It is true that their use may have been for baking in under-ground ovens, a practice found among races who are stone-boilers, and others who are not. But it is actually on record that the wild Irish, of about 1600, used to warm their milk for drinking with a stone first cast into the fire (J. Evans, in 'Archæologia,' vol. xli.)."—'Researches into the Early History of Mankind and the Development of Civilization,' by Edward B. Tylor, D.C.L., F.R.S. 3rd Ed. (1878), p. 268.—Ed.

Mr. Worthington Smith sent an original MS. description of two new species of *Agaricus* in the handwriting of Elias Fries, the great Swedish botanist. Mr. Smith wrote:—"As far as I know, the plant referred to in the first description has not been found elsewhere than in Epping Forest by myself. Fries, as you see, named the plant '*Agaricus* (*Stropharia*) *Worthingtonii*,' after me. The second description is the original one of a new species sent on by me to Fries. He named it '*Agaricus* (*Entoloma*) *Saundersii*,' after my friend Mr. W. Wilson Saunders, who lighted on it."

Prof. Boulger said he hoped the Club would carefully collect and preserve such relics. In his own researches into the history of Botany he had often found how useful it was to be enabled to identify a *hand-writing*.

Mr. English exhibited some flowers and leaves of plants beautifully preserved with their natural forms and colours by his process, which he had improved since his communications to the Club. Full details will be given in his book, now preparing for publication.

Mr. Letchford sent up a specimen of *Gordius aquaticus* to the Secretary for identification. He had found it whilst moving some damp earth in transplanting a rose-bush.*

Mr. W. Cole called attention to a letter from Dr. C. R. Bree, of Colchester, which appeared in the 'Standard' for January 28th, respecting the Hawfinch (*Coccothraustes vulgaris*) in Essex. After referring to the fact that the bird was more numerous this season than he ever remembered, Dr. Bree went on to say, "When first discovered in Epping Forest by the late Mr. Doubleday, the Hawfinch was pretty well confined to that locality as a breeding-place, at least so far as general knowledge went. Since then it has gradually come to breed all over the country. I have known it as a breeder in this neighbourhood for the last ten years. Ambrose, the local birdstuffer here, tells me he has had upwards of thirty this year. There are more than twenty now in his shop. He says they come from all parts of the neighbourhood. One boy caught seven in a garden near the river, and they can now be had alive. Naturalists will, I am happy to say, endorse my statements as to other parts of the kingdom. Unfortunately it is an easy bird to catch in bad weather." In a private letter to the Secretary, dated February 1st, Dr. Bree adds, "Henry Doubleday, of Epping, discovered this bird breeding there. It was not known generally, or there would not have been many left. As stated in my letter to the 'Standard,' I have known of its breeding near Colchester for the last ten years. It has occurred during the late severe weather in

* The *Gordiacea*, or hair-worms (sub-kingdom *Annuloida*), are parasitic in their earlier stages in the perivisceral cavities of the bodies of various insects. When sexually mature they leave their "hosts," and deposit their ova in water or moist earth. The popular name is expressive of their excessively elongated form, and as they are often found in water or in puddles after heavy rain, it is a vulgar notion in some parts that they are the living embodiments of *horse-hairs* which, falling into the water, have been, by a process of "abiogenesis," transformed into worms! Mr. Letchford's specimen was fully eight and a half inches long, and of the thickness of ordinary packing-thread. It lived for several weeks in a vessel of water.—Ed.

all the villages round. It is a shy bird, and does not appear until forced by hunger."

Mr. English said that, in his opinion, the great habitat of the Hawfinch in Essex was Epping Forest. He had seen flocks of two hundred to three hundred at one time. They fed principally upon the seeds of the hornbeam (*Carpinus*), and in winters like the present, when hornbeam-seeds were scanty and the weather very severe, they spread over the country to villages and gardens in search of food.

Mr. H. J. Barnes said that a friend of his had a living specimen of the Hawfinch caught during the late frost, in Victoria Park, South Hackney.

Mr. W. White read a paper entitled, "Is *Vanessa polychloros* the prototype of *V. Urticæ?* A query suggested by the aberrant form of a specimen of *V. Urticæ* of *polychloros* type" [Transactions, ii., 1]. Mr. White exhibited specimens in illustration of his paper, and the President also brought up some British and foreign species of the genus *Vanessa*, for the purpose of emphasizing some critical and extended observations upon Mr. White's essay.

Professor Boulger gave a careful and lengthy exposition of his views on that difficult question, "The Evolution of Fruits" [Transactions, ii., 8], illustrating his observations by specimens and drawings on the black-board.

Hearty votes of thanks were passed to Mr. White and to Prof. Boulger for their communications.

At the Conversazione Mr. C. Oldham exhibited a series of crag-fossils from Walton-on-the-Naze, Essex, and a white aberration of the Hedge-Sparrow (*Accentor modularis*) from Wisbeach St. Mary's, Cambridgeshire.

Saturday, March 26th, 1881.—Ordinary Meeting.

The fourteenth Ordinary Meeting was held at the head-quarters at seven o'clock, the President in the chair.

Donations of books and pamphlets (exclusive of exchanges with various Societies) were announced from Mr. B. G. Cole (2 vols.), Mr. W. H. Dalton, and Miss E. A. Ormerod, and thanks voted to the donors.

Mr. A. Lockyer announced that the Library and Museum had been furnished, and that various gifts and aid had been afforded by Messrs. P. Copland, A. Lockyer, and H. A. Cole.

The following persons were elected members of the Club:—G. H. Baxter, W. H. Bird, F. Cory, M.D., L.R.C.P., F.R.G.S., &c., A. G. Challis, W. H. Edinger, F. G. Harrison, Clermont Livingston, M.E.S., George Perry, Mrs. Perry, Henry Spring, and A. J. Yorston.

The President exhibited some specimens of the small destructive beetle, *Hylurgus piniperda*, which had been sent to him for identification. They had been confined in a glass tube fitted with a cork, and they had eaten their way out into the open air, completely destroying the cork.

The Rev. F. A. Walker, B.D., F.L.S., communicated two papers entitled, "Hunstanton and its neighbourhood in 1878" and "Hunstanton and its neighbourhood as visited in 1880." These were voluminous papers, giving details of the Architecture and Archæology of the village, with notes on the Natural History of the Coast, &c.

Mr. W. H. Dalton communicated a paper entitled, "The Blackwater Valley, Essex" [Transactions, ii., 15]. The paper was illustrated by the exhibition of a large coloured diagram, of which Plate I. is a reduced copy.

On the motion of Mr. Meldola a cordial vote of thanks was accorded to the authors.

The President then gave by word of mouth the exposition of his views with regard to the development of the *Noctuæ* embodied in his paper, "The Developmental Characters of the *Larvæ* of the *Noctuæ*, as determining the position of that Group" [Transactions, ii., 19]. The speaker demonstrated portions of his subject by means of drawings on the blackboard, and Mr. W. White brought up for exhibition a fine collection of "preserved" specimens of caterpillars for the purpose of illustrating Mr. Meldola's remarks.

The Rev. W. Linton Wilson, in thanking Mr. Meldola, congratulated him on the method and perspicuity of his remarks, and hoped that the President's example might prove an incentive to others to bring before the Club the results of their studies and observations.

Mr. W. Cole also hoped that some of their entomological friends would follow the line of investigation so admirably sketched out by Mr. Meldola. He would caution intending observers that the earliest stages in the lives of caterpillars were often extremely transient. In many cases it would even be necessary to dissect out in glycerine the embryonic *larva* from the hatching egg, and examine with a low power of the microscope.

Mr. White said that the paper was highly suggestive of good work to be done by the earnest Lepidopterist in tracing out, with scientific methods and motives, the life-history of even the commonest and presumably the best-known species. He was convinced that most interesting facts would result from a series of careful observations, particularly if attention were directed to the very early forms of the caterpillars mentioned by Mr. Cole.

The President, in returning thanks for the kind reception of his paper, made some announcements of Field Meetings and other matters, and said he could not refrain from congratulating the Club and all who valued the integrity of their fine old Forest on the fact that the Great Eastern Railway Company had, in deference to public opinion very widely and strongly expressed, withdrawn the objectionable clauses relating to the projected line through the Forest from their Bill then before Parliament. (This announcement was greeted with loud and protracted cheering.)

The Hon. Secretary was very glad to say that most of the principal Natural History Societies in and around London had, at his suggestion, joined the Essex Field Club in protesting and petitioning against the

Railway; but the labour and credit of organizing the successful opposition to this atrocious Bill had in great measure fallen upon and belonged to their colleague, Mr. Francis George Heath, and he was sure the Club would accord that gentleman a very hearty vote of thanks for his spirited exertion in the cause. Mr. Fisher Unwin heartily seconded the motion, but warned lovers of the Forest that in all probability the snake was but scotched, not killed. Vandalism was evidently rampant in certain high places, and attempts to destroy the Forest would still be made.

The vote was unanimously passed, amid cheers.

At the Conversazione various fossils were exhibited (and presented to the Club) by Mr. A. Tozer; a very curious instance of *fasciation* in the common garden "Sweet-William" (*Dianthus*) was shown by Mr. Oldham. It had appeared two years running in plants in his garden at Woodford. Mr. Letchford showed under the microscope specimens of the fine Infusorian, *Bowerbankia imbricator;* and Mr. English brought up a case of specimens of preserved *Fungi*, intended for the forthcoming Fisheries Exhibition at Norwich. The collection comprised thirty-nine species, many of considerable rarity and interest. In view of the Club's visit to Waltham Abbey, Mr. Unwin exhibited his collection of views of the Abbey Church and Town. Mr. Waller, of Tottenham, sent specimens of mosses from Epping Forest, including *Dulcranum glaucum* in *fruit*, which he considered to be a rare event.

Saturday, April 2nd, 1881.—Field Meeting.

In view of the doubtful quality of the weather to be anticipated at the early season of the year, it was decided to hold the first Field Meeting at Waltham Holy Cross, Mr. George H. Birch, M.R.I.B.A. (*Hon. Sec. to the* London and Middlesex Archæological Society) very kindly offering his valuable services as *cicerone* at the Abbey. The bulk of the members travelled by train from Liverpool Street Station to Waltham, others by road in a drag from Buckhurst Hill; and the united parties assembled at the Abbey-gates at about four o'clock, between seventy and eighty in number. The visitors were met at the Church by our learned Conductor, our members Dr. Priest and Mr. W. T. Wakefield, Rev. F. Johnstone, Mr. Churchwarden Gardener, Mr. W. Winters, F.R.H.S., and other local gentlemen. Much regret was expressed at the enforced absence, through illness, of the Rev. J. Francis, M.A., the Vicar, who had taken great interest in the proposed Meeting.

The company having assembled in the nave of the grand old building, Mr. Birch commenced a chatty description of the Church, explaining its architectural features and dwelling upon the historical memories still lingering around the fane of "Harold infelix"—our last English king. He pointed out that but a comparatively small fragment of the original had lasted to our times, but doubtless the part in which they then were

was of Harold's age. The Church built by Harold was consecrated about 1059; that was known to be the case because the names of the Archbishop and Bishops who attended the ceremony were all preserved, and the dates of their episcopates were known. Edward the Confessor and his Queen were also present at the consecration of the Church. From 1059 until 1177 no very great alteration took place in the Church; but at the latter date Henry the Second altered Harold's foundation altogether, by making it for monks instead of seculars. The large monastic buildings necessary for the accommodation of the abbot and monks which existed to the north of the Church were then erected; but he fancied that at that time there must have been some slight alteration made in the Church itself in regard to ornamentation—it occurred to him, from the existence of some chevrons, that they were then rather displeased with the baldness and plainness of some of the work and tried to improve it. It would be as well if those present would try to realise what the Church had been. It was just probable that in 1177 the original choir of Harold was extended farther to the east. Alluding to the Lady Chapel, Mr. Birch described it as a very beautiful little building, and said that the architectural work of the Chapel was almost unique in its sort; he knew very little work like that in England. Referring to other points in connection with the Church, Mr. Birch said that the existing tower at the west end was built in 1558. The baptismal font was the ancient one. It was composed of a beautiful block of Purbeck marble; but the shape had been altered, so that its present form was modern. Under Mr. Birch's guidance a thorough inspection of the Church was made, both inside and out. The only large tree in the churchyard is an Elm, supposed to be 300 or 400 years old; it measures 22 feet round the base, and 20 feet round the centre of the trunk, the height from the ground to the head being 12 feet; the main limbs were lopped off, but the tree is still living. The Abbey-grounds were visited, and on the north-east side of the churchyard, in Mr. King's garden, an ancient groined building called the "Potato Cellar," from its present ignoble use. Mr. Birch said in regard to this room that he did not think it was originally a chapel, as it ran from north to south; he thought that it was a portion of the Abbot's house or hospicium. As to the fact of the room being now unlighted by windows, there were traces of the wall having been disturbed, and it might very likely have been originally lighted by lancet windows; but Mr. Winters pointed out a ring which still remains in the centre of the groined ceiling, from which a lamp may have been suspended.

The Vicar had most kindly placed his private school-room at the disposal of the Council, and in it a kind of temporary Museum had been gathered together, chiefly by the exertions of Mr. Wakefield and Dr. Priest. The objects were very well displayed in the well-furnished room. Amongst other things Mr. Wakefield exhibited some coins found at Waltham Abbey; a series of 17th century tokens from Waltham, Colchester, and other Essex towns; seals, &c.; also a long and valuable series

of Greek, Roman and English coins; a large selection from his collection of fossils ranging from the Silurian to the Newer Pliocene formations; and a very massive microscope, made many years ago by Powell and Lealand, and presumed to be one of the two largest instruments in existence. The Rev. J. Francis showed some relics belonging to the Abbey, discovered at the time of its restoration in 1860; Dr. Priest some skulls and bones of Deer, Bison, &c., found, while digging the foundations of the New Powder Mills, in the peat-beds which extend over most of the marshes near the town; they were exhumed from the depth of ten or twelve feet, a number of other bones and horns of Deer, &c., being found at the same time, which are now in the British Museum; also a flint axe, and various drawings and engravings of the Abbey. Mr. Winters, F.R.H.S., brought up a copy of the foundation charter of the Church of Waltham, dated 1062, containing names of lordships and witnesses to the grant; a representation of the great east window of the parish Church of St. Margaret's in Westminster, which window was removed from Waltham Abbey at the time of the dissolution; autograph of Dr. T. Fuller, author of 'Church History' and 'History of Waltham Abbey,' who was a Vicar of the place; facsimile of the Domesday Book, and deeds relating to Waltham. Mr. Fisher Unwin exhibited a large number of interesting plates and drawings of Waltham Abbey and the Eleanor Cross at Waltham Cross, and some old county histories; Mr. Walter Crouch a series of prints illustrating the architectural details of the Abbey, and the ancient market stocks; Mr. Corder some flint implements found near Chelmsford. Other objects were shown, and, all being carefully labelled and explained by Dr. Priest and Mr. Wakefield, the whole formed a very interesting collection.

The members and major portion of the visitors sat down to "high tea" at the "Cock Inn," excellently served by Mr. and Mrs. Giles. After tea a meeting was held in the "temporary Museum," the President occupying the chair. He expressed his pleasure in bidding welcome, on the part of the Council, to those present at that their first Field Meeting of the season, and hoped it would be the first of a series of equally successful meetings and a good omen of the future (Applause). The Chairman then introduced Mr. Birch, who gave some further details concerning the Abbey Church, commencing his paper by observing that, in the present age, facts which had been believed in for generations were subjected to searching criticism, to discover flaws and to raise doubts. It was not his intention to raise any doubts then. He would ask them to accept as a fact that Harold really lived and was buried at Waltham Abbey, and by thus begging the question he would dispose of a quantity of matter with which they had little to do in describing the building in question, which was anciently known to pious worshippers as the Church of the Holy Cross at Waltham. Harold was not the real founder of this famous Abbey. To discover who that founder was, we must transport ourselves to a good half century previous to Harold's time. About the year 1000 there was a great religious enthusiasm. That year was devoutly

believed to be the end of the world, and the last swell of that great wave of enthusiasm had not entirely subsided when the miraculous cross which was brought to Waltham and deposited in the church erected there was discovered. It was a miracle-working age, and no wonder that a miraculous crucifix was found under-ground, possessing extraordinary virtues, and demanding extraordinary devotion on the part of the faithful. Tovi, who lived in the time of King Canute, was the first to set aside a portion of his land for the purpose of building a church at Waltham. After Tovi's death the lordship of Waltham seemed to have reverted to the Crown, and subsequently Harold enlarged Tovi's foundation for two priests to one for a dean and twelve canons. The regular clergy or the monks had not then attained the footing in England which they afterwards did. We did not during several succeeding reigns hear of any alteration in Harold's Church, which was consecrated in 1059. The founder himself had been found under a heap of slain, and had been laid to rest in the choir of his own Church. A wonderful tale of how Harold had escaped, and had had several subsequent adventures and admitted that he was Harold, had been invented; but that legend could not bear the test of historic research. In the year 1177 an important change took place at the church at Waltham, when Henry the Second enlarged Harold's original foundation. Henry's work was probably limited to the choir, of which nothing now remains, and to the conventual buildings, of which fragments do remain. In 1242, in the time of Henry the Third, we hear of the Abbey Church of Waltham being consecrated, proving that some alteration had been made in the east end of the Church; that the altar had been moved, thus causing the choir to require re-consecration. There is thus very little doubt that Harold's choir had been pulled down, and a more magnificent choir built. He believed that, in making excavations at the east end of the present Church, foundations were discovered on the north side for a long distance in a line with the present walls, proving that the choir was a very long one, probably nearly the same length as the nave. There was found no wall on the south side to correspond with that found on the north side; the foundations on the south side had been entirely removed. Afterwards a beautiful Lady Chapel was built on the north side of the nave. From the character of the work of the Chapel, one would imagine that it was early 14th century; but he thought that it was a little later than that, and dated from about 1340. No alteration of any magnitude was subsequently made until the dissolution, after which time as much trouble was taken to demolish as had previously been taken to build. During the reign of Philip and Mary the central tower was blown up with gunpowder. In the 18th century and early in the present all sorts of barbarities were inflicted on the Church, the roof being lowered and two galleries erected at the west end, and the whole area filled with high pews. The present improved state of the Church was due to the work of Mr. Burges, the Architect of the restoration in 1859—60. A few fragments of the domestic buildings of the Abbey even now existed.

There was on the side of the Lea a fine pointed archway, built of masonry largely repaired with red bricks. He believed that in the beginning of the present century a good deal more of that gateway existed; some of it fell. The old Abbey-walls extended for a considerable distance, and a few of those present, he dared say, went into that beautiful little building now called the potato-house. That, as far as he could make out, must have been a portion of the Abbot's house, guest house, or hospicium. Even in its present degraded and dilapidated condition, it was a beautiful specimen of ancient monastic buildings. The destruction of the central tower of the Church of course necessitated the erection of another for the bells, and in 1556 the present tower at the west end was built. He would just say, in regard to Harold, that good men's deeds lived after them, and the massive walls of the Church which Harold had erected remained to test the fact of the survival of the good; and good it was, though there might be a difference of opinion in these days as to the utility of a religious foundation. Harold's name was a memory dear to many, and would be so as long as bravery was held in good repute and misfortunes were pitied. (Applause.)

A considerable discussion arose on some points touched upon in Mr. Birch's paper, in which Rev. W. Linton Wilson, Mr. Godwin, Mr. Robarts, Mr. Fisher Unwin, and Mr. Friswell took part. In replying to these questions and observations, Mr. Birch said there were no remains whatever of Earl Tovi's Church, which was founded about A. D. 1000, and which must have been very small, as the foundation was for only two priests. As to the date of the bridge, which lies a little to the north of the Church and which had been regarded as of contemporary date, he thought it must have been built about the 15th century, as it had a four-centred arch, which did not appear in England till about that time. With regard to the pillars being decorated with spiral lines and chevrons, the description of Harold's Church spoke of Harold adorning his building with plates of metal gilt, and Dr. Freeman as well as Fuller had fancied that brass must have been let into those flutings. All who knew anything at all about brass knew that it was not malleable, like lead; it had to be cast, and therefore brass could never have been put into those chevrons and flutings. However, in making an examination of the pillars that day, he (Mr. Birch) had noticed marks of rivets, and it certainly occurred to him at the time that Dr. Freeman was not after all so very far wrong. The question was, whether some copper-gilt or other metal might not have been so inserted. As to the stone of which the Church was constructed, he thought it was Carnac, and there would be no difficulty in accounting for its transportation to Waltham—it was probably brought up the Thames and the Lea. It was not Caen stone, which was not introduced into England until a later period.

A very hearty vote of thanks was passed to Mr. Birch for his valuable dissertation and the assistance given during the meeting; also to the Rev. J. Francis for the use of the room, and to Dr. Priest and Mr. Wakefield

for their exertions, on which the success of the meeting had so much depended. After a short Conversazione, the members made their way home, in companies, some by rail, some by road; whilst a select band chose rather a walk across the valley, and through the Forest to Buckhurst Hill, Woodford, and Chigwell.

Saturday, April 30th, 1881.—Ordinary Meeting.

The fifteenth Ordinary Meeting was held at the head-quarters at 7 o'clock, the President in the chair.

Donations of books, pamphlets, and periodicals, &c. (exclusive of "Exchanges") were announced from Mr. B. G. Cole (2 vols.), Mr. W. Cole (16 vols. and numerous pamphlets, &c.), Mr. P. Copland (9 vols., with the 'Zoologist' and 'Journal of Botany,' monthly), Edinburgh Geological Society (3 vols.), Mr. G. S. Gibson, Mr. J. E. Harting (3 vols.), Mr. A. Lockyer (3 vols.), Mr. G. H. Lockyer, Mr. F. T. Lockyer, and Mr. W. White (pamphlet and map). A unanimous vote of thanks to the donors was passed.

The following gentlemen were elected members of the club:—Charles A. B. Brooker, Henry Bliss, Frederick W. Cory, M.R.C.S., F.M.S., &c., John Chambers, M.R.C.S., &c., Rev. Albert Hughes, M.A., Thomas King, J. W. Lawson, G. C. Locket, Rev. A. Gray Maitland, F.R.G.S., Benjamin Newling, M. Whiteley Williams, F.C.S., F.I.C.

On the motion of the Secretary, it was agreed that Mr. James Fletcher, President of the Ottawa Field Naturalists' Club, who was about to visit England, should be admitted to the full privileges of membership during his stay in this country.

The Secretary said that Mr. W. H. Dalton, F.G.S., had asked him whether any member could record *Cyclostoma elegans* as now *living* in Essex. Mr. Dalton wrote:—"I have found it, and so has Mr. Christy, abundantly in very modern alluvium and spring-peat, but never living, and I fear it is extinct. Query, from what cause. . . . . I have found *Cyclostoma* in peaty alluvium at Rivenhall (Witham, Essex), and Wormingford (Nayland, Suffolk); and Mr. Rowe, of Felsted, sent me a very recent looking specimen from surface-soil there, but I never could hear of it living in Essex. The chalky boulder-clay is quite calcareous enough for it, but there may have been some slight alteration of environment to extinguish it lately. *Achatina acicula*, supposed to be rare, is very common in South Essex. A good habitat for the dead shells (*Hibernice dictu!*) being ant-hills in grass-land (*Formica flava* or *rufa*). The same heap should be looked over frequently, as the shells are worked out by rain to the surface."

Mr. Walter Crouch (who brought up some fine specimens of *Cyclostoma* for exhibition), said he had never found the shell in Essex either living or dead, nor had he heard of specimens being found in the county. It

was a well-known species, common on chalky soils, and he had seen it in Kent, Sussex, Surrey, Wiltshire, and on the limestone in Derbyshire, &c. It evidently prefers, and most likely requires, chalk or lime for its operations. He suggested that search should be made at Purfleet or Grays, on the chalk, for the mollusc.

The President said it was clear from Mr. Dalton's and Mr. Christy's observations that *Cyclostoma* had once lived in Essex, possibly finding suitable conditions in the chalky boulder-clay; and he suggested the possibility that the disappearance of the species was due to the removal of the chalky clay by superficial denudation and other causes.

Mr. H. J. Barnes exhibited some shells of a species of *Ostræa* found in large quantities in digging a new sewer at Leyton at a distance of about twenty feet from the surface.

Mr. H. Corder exhibited, and read some notes on, three Neolithic Implements from the neighbourhood of Chelmsford [Trans. ii. 29.] He also exhibited and explained some ancient Bronze Implements ("Socketed Celts"), found two years ago in a field near Little Baddow, Essex [Trans. ii. 31], and some bones of Pleistocene *Mammalia* from the brick-earth, Chelmsford.

Mr. James English read a paper entitled "The First Night's 'Sugaring' in England: a reminiscence of Epping Forest in 1843" [Trans. ii. 32.]

Mr. Meldola said he was sure Lepidopterists would read with pleasure Mr. English's chatty account of the earliest application of a process to which they owe a revolution in the extent and beauty of their collections. One interesting fact appeared to be clearly established by the use of the method of "sugaring," and that was the possession of an organ of smell by Lepidoptera and other insects. He suggested that it would be an important experiment to remove the antennæ of moths, and see if they found their way to "sugar" when thus mutilated. In the course of conversation Mr. English expressed his belief that moths would not come freely to sugar when the trees were infected with honey-dew, and that the circumstance explains one at least of the causes of the uncertainty of sugaring as a mode of collecting.

A unanimous vote of thanks was passed to the authors for their papers.

At the Conversazione Mr. J. S. Morten exhibited, under the microscope, some specimens of parasites belonging to the genera *Argas*, *Trichodectes*, and *Hæmatopinus*; Mr. J. D. Cooper two Flint Spear-heads and a Knife from the Ancient Indian Burial Mounds near Belize, Central America; and Mr. W. Cole a series of *Noctuæ* for the purpose of illustrating Mr. English's paper.

Saturday, May 14th, 1881.—Field Meeting.

Excursion to Grays Thurrock, Essex. Conductors: Professor John Morris, M.A., F.G.S., and Henry Walker, Esq., F.G.S.

[*For the Geological portions of this report the Editor is indebted to the kindness of Mr. Walker, who supplied the admirable résumé embodied in the following pages.*]

This being an excursion in conjunction with the Geologists' Association, the members of the two Societies assembled in very considerable numbers, leaving Fenchurch Street Station by the 2.25 p.m. train. The route for almost the entire distance lies across the gravel and alluvial flats of the Thames Valley. The wide and shallow tributary valleys of the Lea and the Roding, as they were successively passed, were well seen. During the remainder of the journey the nearer features southwards are the *levées* confining the River Thames within its modern artificial channel, whilst beyond is seen the bold and natural horizon formed by the chain of hills stretching from Greenwich to Erith, the southern limit of the valley along that line. On nearing Purfleet, the western outcrop of the small area of chalk which is found in South Essex begins to be visible. On nearing the station, and looking to the left-hand side of the railway, an old chalk-pit, abandoned now to the botanist and entomologist, reveals both the chalk and the Thanet sand, the latter capping an isolated mass of the former. Past the station the bare sides of the great conical mound of Thanet sand, having a high angle of rest, and being a very conspicuous object from the Erith side of the river, is close at hand. The remaining three or four miles of the journey lie along the West Thurrock Marshes, but on the left the presence of the chalk skirting the railway is told by its characteristic contours.

Alighting at Grays, the party received some notable reinforcements, and the united forces, considerably exceeding one hundred in number, were conducted by Mr. Walker to the high road leading to Stifford. Here the extent and position of the three southern chalk-pits are well seen; the East Pit; the Central Pit (appropriated for the manufacture of whitening); and the Western Pit, occupied by the South Essex Waterworks Company. Attention was called to the flooded condition of the Eastern Pit, the floor having been worked down to the level of the springs, and the pumping being temporarily suspended. The sides show the green-flint bed lying on the surface of the chalk, and the Thanet sand above. The islands below, overgrown at the surface with vegetation, but revealing on their bare sides a sharp dip of their component strata, were here the subject of some cautionary remarks; their real character as spoil-heaps, or "tips" of Thanet sand and gravel, has not always been recognised, even by geological visitors. A descent to the central pit was then commenced. On the way one of the Greywethers or Sarsen-stones, for which Grays has long been notable, was found lying on the unworked surface of the chalk, at a spot

where the Thanet sand had been breached, and was the subject of an exposition from Professor Morris. Its surface showed the mammillated appearance so frequently found in these concretions. (Some very large and characteristic examples are to be seen in the adjacent village, near the wharf of the Grays Chalk Quarries Company.) The Professor pointed out that these rounded appearances were not due to the wear and tear of transport. A thin flake examined by the microscope would show the sandstone to be composed of subangular quartz grains, and not of these grains rounded. Looking at the range of the Bagshot and Thanet sands, which at one time extended all over the valley of the Thames, he was inclined to consider these Greywethers as derived from the indurated base of the latter; the softer sand had been carried away by denudation.

On reaching the floor of the pit, which is excavated one hundred feet into the chalk, the party examined the fine vertical sections which are there exposed, consisting of upper chalk, with green-flint bed, Thanet sand (in some places twenty-five feet in thickness), and High Terrace Thames Valley drift. Some of the "sand-pipes" here are sixty and seventy feet in depth, partially filled, in some instances, with gravel, and in others with Thanet sand. Sir Antonio Brady, who was present, called attention to one of the more remarkable, which had penetrated below a horizontal band of flint without disturbing it. Mr. Walker gave a general account of the structure and composition of the rocks here exposed; the chalk, with its marine organic remains, more especially its sponges, corals, "sea-urchins," mollusca and fishes (a large number of the curious palatal teeth of *Ptychodus* and other sharks were shown subsequently); the Thanet sand, marine but unfossiliferous, near London; and the "High Terrace Thames Drift" of Professor Prestwich and Mr. Whitaker (the "Marine Gravel" of Mr. Searles Wood). Prof. Morris followed with a comprehensive review of the history and former range of the chalk, Thanet sand, and other Eocene beds now missing below the gravel, especially descanting upon the great physical changes which had taken place in the face of Europe (such as the elevation of the Alps), in the interval denoted by the absence of the Woolwich beds, Oldhaven pebbles, London clay, and Bagshot sand. Referring to the Green-flint bed (the "Bull-head bed" of the workmen), Professor Morris called attention to the well-marked concentric structure of many of the flints, probably owing to the presence of iron, which tends to this arrangement. The solvent action of carbonated waters, which formed the "pipes," was also seen, the Professor said, in the undulating surface of the chalk, as traced by the course of the green-flints. The depressions in this line were therefore posterior to the elevation and desiccation of the sea-bed. With regard to the absence of Woolwich beds and London tertiaries which once overlay the Thanet sands, he pointed out that the Woolwich beds were found about a mile further inland, at the village of Stifford, and he would suggest to the Essex Field Club an examination of them at that spot, inasmuch as the only instance of a certain shell of the Woolwich

and Reading beds obtained north of the Thames had been found there. He thought the Club might do good service to geology by carefully investigating the strata referred to at Stifford.

At the conclusion of Professor Morris's remarks Mr. J. Spiller, F.C.S. (Treasurer of the Photographical Society), took a photograph of the group, and also obtained some negatives of the sections exposed in the workings. A print from one of these, produced by the Autotype Company, is given as a plate* accompanying this report. The photograph shows one of the larger "pipes" in the chalk at Grays. The view is in the South Central Chalk-pit, and the "pipe" is seen in shadow in the left foreground of the picture—a wide and irregular-shaped cavity traceable down to the floor of the pit, a distance of more than ninety feet vertical, and containing deposits from the overlying Thanet sand and high-level drift gravel.

Other "pipes," in a less advanced stage of erosion, are shown in the centre and to the right of the picture.

The abandoned Western Pit, in which the South Essex Water Company obtain their supply, was then visited. In the engine-house Mr. Walker stated that, in 1860, the chalk had been worked to the level of the springs in this pit over an area of some sixty-five acres, when attempts to go deeper led to the discovery of an abundant supply of pure water and the formation of the Company. The water passing over the gauge every twenty-four hours was found to exceed 1,200,000 gallons, and even with five engines at work it became necessary to brick-up fissures, so as to keep the water down. Mr. Prestwich, in accounting for this volume of water in an area where the superficial pervious beds do not exceed five miles in extent, extends the receiving ground to the area of the Kentish chalk, as well as to the northern chalk area which begins beyond Bishop's Stortford and Dunmow; considering that the Thames, which opposite Greenhithe and Dartford is not, even at high tide, more than fifty or sixty feet in depth, would not intercept all the springs.† The daily quantity now yielded is about 1,300,000 gallons, of which 600,000 gallons is pumped to waste to avert inundation. Owing to the low level to which the chalk has been worked, the water is found near the surface, the engine-house floor being seventeen feet above Ordnance datum, and the water in the well varying from that line to eight feet below it.

This old chalk-pit would seem to be a capital hunting-ground for both entomologists and botanists. There is plenty of undergrowth and chalk-loving plants, the *Clematis vitalba* being notably luxuriant; but the claims of the geologists were so imperative that no time was allowed for herborizing. In the sections of the Thanet sand an abundance of the

* Our members will be pleased to learn that we owe this interesting and instructive record of a pleasant meeting to the kindness of the three following gentlemen, who reimbursed our Treasurer for the cost of the plate in the manner following:—Mr. Meldola, £2 2*s.*; Mr. John Spiller, £1 1*s.*; and Mr. Harcourt, 10*s.*—Ed.

† 'Report of Water-springs at Grays.' Privately printed, 1860.

burrows of Fossorial Hymenoptera were noticed, and Mr. W. F. Gwinnell gathered from the *Artemisia vulgaris* (mugwort), growing on a large ballast-heap to the north of the engine-house, a reddish gall, which eventually turned out to be new to Britain. [See Proceedings, May 28th.]

The steep ascent to the high ground between the northern and southern pits was then commenced. At the summit a wide view of the landscape and its geological features, especially southwards over the Thames, is obtained. The character and origin of the scenery was described with much eloquence by Professor Morris. On the north was seen Laindon Hill (388 feet), where the Bagshot sand caps the London clay; the Tertiaries covering the country as far as the eye could reach. At the same elevation, on the opposite side of the Thames, a widely different development of the rocks was seen. Owing to the continued uprise of the beds towards the Weald, the chalk, which on the Essex side of the valley is brought to the surface by an arch limited to the Thames Valley, soon becomes in Kent the surface rock of the district, rising at Knockholt to 780 feet. From the height at Grays, the wooded Tertiary outliers which diversify the comparatively treeless chalk country were pointed out; Swanscombe, with its capping of London clay, and Cobham Mount, capped with Oldhaven pebbles, being prominent examples. The geological causes of the survival of some of the older features of the country and the destruction of others were instructively described by Prof. Morris; and with this exposition the afternoon's pleasant series of sermons in stones may be said to have terminated. Prof. Morris had to leave for town, and Mr. Walker gracefully expressed, on behalf of all present, the great pleasure and profit they had derived from his teachings in the field that afternoon.

It was found to be impossible to carry out the intention of visiting the brick-earth beds at Little Thurrock ("Globe Cement Company's Works," permission to visit which had been kindly given by C. J. Mander, Esq.); and shortly afterwards the members of the Club, with many of the Geologists' Association, including the genial Secretary, Dr. Foulerton, F.G.S., wended their way back to Grays, and sat down to tea at the "King's Arms Hotel," served in capital style by Mr. Cuming; albeit there was not room for all at the Inn, and many had to seek accommodation elsewhere.

The President afterwards said that he thought such a juvenile Association as theirs might congratulate itself upon having been associated with such a veteran body as the Geologists' Association. He was rather glad that they had not been able to carry out their full programme, because this might serve for an excuse for joining again with the Association to finish off the beds at Little Thurrock. (Cheers.) Their thanks had been expressed to the veteran geologist who had left (Professor Morris), and it was now his pleasant duty to express their thanks to their worthy conductor, Mr. Walker, for his admirably-rendered services. He very much regretted that time had left them with only a very few moments

to attempt anything in the way of discussion. Many geologists had left, but he saw they had with them Sir Antonio Brady. He was afraid, however, that it was too late for any real discussion.

Mr. Walker, in replying, said he wished to mention one or two facts which had not yet come under their notice. The reference to the Geologists' Association in connection with the Essex Club was very satisfactory to him; he was an early member of the Association, and was always glad to bear testimony to the work which it had done, especially as it was one of the oldest of the London amateur Natural History Societies—older even than the Quekett Club, for which precedence had been claimed. None of them who met for out-door work in Natural History could be ignorant of the great work of propagandism which was carried on by the Geologists' Association. He was exceedingly glad of the muster that day, because in these days the interdependence of the sciences had gained such a recognition that no man could safely restrict his enquiries to one branch. Therefore it was desirable that the faunists and others who were not geologists should become so as soon as possible. And as their excursions took them some twenty or thirty miles out of town at a time, it was economy of time and opportunity to observe in more than one department of Natural Science. In the field that day they could pursue Entomology, and they could find many interesting plants, as well as study Geology. He apologised for the curtailment of the programme, and stated that he had been down there twice rehearsing the excursion. He had been all over the fields at Little Thurrock, and had found there about twelve feet of false-bedded sands, the most beautiful example of that phenomenon near London; he thought that it beat even that at Finchley. There they saw stereotyped in permanent form what was going on in the Thames to-day—shallow-water deposits pitched down at a low angle, and then denuded subsequently. They would have a very good chance at Grays of noticing how the Thames once flowed in a valley parallel to that in which it now flows. The false-bedded sands and the elephant beds lay in an inland trough, a good half-mile from the Thames, and the southern rim of that trough was just before you got to the present bed of the Thames. There were the two cuttings side by side—two troughs cut into the chalk. This accounts for the remains in the old trough—the deposit of elephants and so on. The Thames had a way of changing its course, and if we had not embanked it in these latter days it would very soon have shown us that it did so. But we had now imprisoned it and made it a canal. He did not know, he said, what they had done to deserve a second lecture; he would conclude by thanking them, and by saying that his reward had been the sincere interest with which every member had entered into an examination of the phenomena before them. They did not come out for a pic-nic, but to enrich their minds. The man who learned his Geology simply from books was a very poor thing, as they knew; but the man who came out to study in the field, as they had done, made acquisitions which could be gained in no

other way. They were privileged to have with them Sir Antonio Brady, the veteran elephant hunter in Essex. His work was historic—(cheers),—but happily he himself was not yet historic.

Sir Antonio Brady, after expressing the pleasure he had derived from the meeting, and from seeing and hearing his old friend, Professor Morris, discussed at considerable length the various theories which had been put forth to solve the geological problems which they met with in the deposits of the Thames Valley.

Mr. Worthington Smith, F.L.S., said he had been to West Tilbury by an earlier train than the main party, and had walked over the country to Grays, managing to find four flakes of Palæolithic age in the high gravels; he had previously found the butt-end of an implement and several flakes in the high gravels capping the chalk at Grays Thurrock. Mr. Smith referred to the numerous "Dane-holes," some open and others filled in, at Hangman's Wood.* He said these places were doubtless shafts dug in Neolithic times in quest of the layers of flint found in the chalk, and were comparable with the pits at Cissbury Camp, Worthing, examined by General Pitt-Rivers ('Archæologia,' xlii., 27). Mr. Smith had at different times found numerous flakes of Neolithic age round these pits, and indeed had lighted upon some that morning. He strongly advised that the pits should be investigated by the Essex Field Club, and reported upon. The rustics in the neighbourhood sometimes descend these places by the aid of ropes.

* These remarkable relics at Little Thurrock and elsewhere have been somewhat perfunctorily noticed by various antiquarian writers from Camden downwards. An account of them, with a ground-plan of one of the pits, is given in Palin's 'Stifford and its Neighbourhood,' p. 93, and the same author's 'More about Stifford,' p. 38. From the latter work we quote the following description, communicated by Mr. R. Lloyd Williams, of Grays:—"Hangman's Wood is a small wood, partly in the parish of Little Thurrock and partly in Orsett. At the south of this wood and on the Chadwell boundary are traces of numerous pits, which at some time or other must have existed there. Most of them are now completely filled up or fallen in, but six are still open, three of them almost in the same state as when originally made. The formation of such as are still comparatively perfect, and from which it may fairly be conjectured that the others now closed were not dissimilar, is very curious. A perpendicular shaft of about three feet in diameter, and like that of an ordinary well, descends to a depth of about seventy-five or eighty feet, the lower twenty feet or thereabouts of which pass through the chalk stratum, there reached at a depth of about sixty feet. At the foot of the shaft on each side large chambers are cut out of the chalk, rather oval in shape, with the arching slightly pointed, and the floor tolerably flat; though in one instance there appears to have been left intentionally a rude kind of bench of chalk. The measurements of these chambers vary, but their height, as a rule, is about sixteen feet, length about twenty feet, and width about fourteen or fifteen feet in the widest part." Mr. Williams conjectures that there must be nearly fifty of the pits in close contiguity. In Swanscombe and Darenth Woods, in Kent, there are similar pits, and the recent remarkable subsidences on Blackheath are by some considered to be due to the presence of these "Dane-holes," the shafts of which have been only partially filled in. No sufficient examination in the light of recent archæological researches has been yet made of these workings; and we hope the Club will adopt Mr. Worthington Smith's suggestion, and institute a practical enquiry into their nature and probable origin at no distant date.—Ed.

Cordial votes of thanks were passed to Mr. Channer, the Secretary of the "Gray's Chalk Quarries Company," to Mr. Anson, the Engineer, and Mr. Philcox, the Superintendent of the Works, for facilities afforded to the meeting. Mr. Philcox brought up a number of interesting fossils from the chalk, including the palatal teeth of fishes, *Echini*, &c.

Mr. Cole tendered his best thanks to the Rev. R. H. Brenan, M.A., Vicar of Grays, for the courtesy with which he had placed his school-room at the disposal of the Council for the discussion of the day's observations, and regretted that time would not allow them to take advantage of his ready kindness.

The 7.58 train took the members up to town, and one of the most numerously-attended and successful meetings since the Club's formation appeared to have been enjoyed by all present.

The brief bibliography of the Geology of Grays, prepared by Mr. Walker for our programme, is reprinted here as an aid to students:—

MAPS.—London and its Environs (Geological Survey Map), 1873. Or Sheet 1, S.W. (included in the above).

LITERATURE.—Prof. John Morris, M.A., F.G.S., &c.—'On a Fresh-water Deposit containing Mammalian Remains, recently discovered at Grays, Essex'. Mag. Nat. Hist., Vol. ix., 261 (1836), and Series 2, Vol. ii., 539.

Prof. R. Owen, F.R.S., &c.—'Notice of the Occurrence of Remains of *Megaceros Hibernicus* and *Castor Europæus* in Brick-fields of Ilford and Grays Thurrock.' Quar. Jour. Geol. Soc., iv., 42.

W. B. Dawkins, M.A., F.R.S., F.G.S.—'On the Age of the Lower Brick-earths of the Thames Valley.' Quar. Jour. Geol. Soc., xxiii., 91.

A. Tylor, F.G.S.—'On Quarternary Gravels.' Quar. Jour. Geol. Soc., xxv., 57. Also issued separately by Geol. Assoc.

Proc. Geol. Assoc., ii., 29, 230, 245. (Contains List of *Mammalia* found at Grays.)

Prof. John Morris, M.A.—'On the Occurrence of Greywethers at Grays.' Geol. Mag., iv., 63.

Prof. Prestwich, M.A.—'Report of Water-springs at Grays.' Privately printed, 8vo, London, 1860.

Do.—'On Sand-pipes at Grays Thurrock.' Geologist, iv., 258.

W. Whitaker, B.A., F.G.S.—Memoirs Geol. Survey, iv., 36, 72, 349. 'Chalk and Thanet Sands.'

Do.—'Guide to Geology of London and the Neighbourhood.' (Geological Survey Memoir.) 'River Drifts,' chap. 6. Third Edition. Price 1*s*.

Searles V. Wood, F.G.S.—'On the Newer Pliocene of England,' with Map Sections, &c. Quar. Jour. Geol. Soc., xxxvi., pp. 457—528.

SATURDAY, MAY 28TH, 1881.—ORDINARY MEETING.

The sixteenth Ordinary Meeting was held at the head-quarters at seven o'clock, the President in the chair.

Donations of books or pamphlets (exclusive of exchanges) were announced from Miss M. Bentley (6 vols.), Dr. Chambers (4 vols. folio), Mr. J. E. Harting, Mr. Fisher Unwin, and Mr. W. White. A unanimous vote of thanks to the donors was passed.

The Librarian announced that during the recess the Library would be open for the exchange of books every Thursday evening from seven to nine o'clock.

The following were balloted for and elected members of the Club:—Miss Madeline Bentley, Samuel D. Clippingdale, John Collingridge, George Corble, G. S. Gibson, J.P., F.L.S., D. G. F. Macdonald, J.P., LL.D., C.E., &c., Major Munro, Burnett Tabrum, J. Smyth Till, Mrs. Warburg, and George Weller, M.R.C.S.

Mr. English exhibited some flowers preserved by his process, illustrative of the advance he was still making in working out the practical details.

Mr. W. Cole said he thought the members would be pleased to hear that, at the Grays Meeting, an addition to the fauna of Essex had been made. Mr. W. F. Gwinnell pointed out to him a reddish gall upon the mugwort (*Artemisia vulgaris*), which he had failed to recognise; but on submitting specimens to their Vice-President, Mr. Fitch, that gentleman had pronounced it to be a gall, new not only to Essex, but to Britain—made by one of the Gall-gnats (Cecidomyidæ), *Cecidomyia foliorum*, H. Loew. Mr. Cole could do little more than announce the fact, but hoped that some information respecting the insect and its gall would shortly be forthcoming. The Club was promised a complete list of the Galls of Essex, with biological notes, by Mr. Fitch, which it was hoped would give an impetus to the collection and study of these interesting and obscure productions.

Mr. Henry Walker said that, whilst on the subject of galls, he might call attention to one which he held in his hand, and which he had found plentifully when taking shelter under some trees at Buckhurst Hill during the storm that afternoon. They were the production of an Aphis known to entomologists as *Pemphigus bursarius*. The presence of the insect, by some irritating but little understood process, leads to the formation of large hollow swellings on the petioles of the leaves of the Lombardy Poplar. On cutting open the galls the apterous larvæ and full-grown Aphis can readily be obtained, and with a little care the winged forms could be bred from the infested petioles of the poplar.

The President stated that the members of the Club present at the last meeting would probably remember that, in connection with Mr. English's remarks upon "sugaring" for moths, he had suggested the experiment of

removing the antennæ of moths, and seeing whether they found their way to sugar when thus mutilated. The object of this experiment was to test the function of the antennæ as organs of smell. Since the last meeting he had met with a paper recently published by G. Hauser (Zeit. für wiss. Zool., vol. xxxiv., 1880, pp. 367—403), in which such experiments had actually been conducted, and which went to support the views advocated. In all the Orthoptera, Pseudo-Neuroptera, Diptera, Hymenoptera, and in many Lepidoptera, Neuroptera, and Coleoptera, a strong nerve had been discovered arising from the cerebral ganglion and passing into the antennæ. A terminal sensory organ with which the nerve-fibres are connected, and accessory organs formed by the pits or cones filled with fluid are described. The author gives detailed descriptions and figures of these organs in the orthopteron, *Calopterus Italicus*. The function was investigated by cutting off the antennæ of insects which had previously been tested by turpentine, carbolic acid, &c. Insects thus mutilated exhibited no repugnance to these odours, nor did they rush to food.

The Secretary read an extract from a letter received from Mr. R. M. Christy respecting the occurrence of *Cyclostoma elegans* in Essex [Proceedings, II., xi]. Mr. Christy had found the shells in considerable abundance in a deposit of alluvium at Chignal St. James, near Chelmsford. Last year, and again this spring, he found several dead shells a few inches below the surface in a railway-cutting close to Saffron Walden, but has not found any living specimens yet. The occasion on which he made his nearest approach to finding it living was one day at the end of last August, when he happened upon plenty of the animals in a wood called the "Rivy Wood," just on the other side of Linton, and also in abundance beside the road right into the town. Now as Linton is built on the very boundary between Cambridgeshire and Essex, he might fairly say that he had found living *Cyclostoma elegans* only a few hundred yards outside our own county, and before the summer closed Mr. Christy was hopeful of being enabled to report the occurrence of the animal in Essex. Another shell he very much desired to find in Essex was *Helix pomatia*.

Mr. Meldola exhibited the larva of a species of *Thera* (either *T. firmata* or *T. obeliscata*) the body of which was neatly and tightly packed with cocoons of some species of ichneumon-fly. The flies had hatched out, and he hoped at a future meeting to give the name of the species.

Mr. Harting presented to the Club a copy of his paper in the 'Popular Science Review,' on the occurrence of the Roe Deer in England, and, in doing so, he hoped the members would do all in their power to investigate the characters and history of the Deer now existing in Epping Forest. He pointed out that there were great differences between the horns of the Epping specimens and the normal horns of the ordinary Fallow Deer; and it would be of interest to endeavour to explain this modification, and to ascertain whether these animals were the descendants of Deer imported into the Forest, or whether they formed the remnant of the ancient breed of Deer surviving from remote times.

Mr. D'Oyley said that there had been no importation of Deer, and quoted the opinion of the late Mr. Grimston, a gentleman well acquainted with the Forest, that these were the descendants of animals which had inhabited the woods from time immemorial. In answer to a question from Mr. Harting he stated that, for some time after birth, the fawns were black, except at the neck, where some white appeared. This fact, Mr. Harting pointed out, was quite abnormal in the Deer-tribes. Luffman, the head keeper in the Forest, had told him that he had heard his grandfather say that Deer had been brought into the Forest; but he (Mr. Harting) did not place implicit reliance upon this, because he had been similarly informed with respect to the Deer in Lord Leconfield's park. These, he had been told, had been brought by Lord Leconfield's father from Windsor; but, on writing to his lordship to enquire, he was informed that the fact was the other way—that some of Lord Leconfield's Deer had been sent to Windsor.

Mr. Meldola observed that the history and nature of the Forest Deer were subjects well within their scope, and he hoped careful enquiries and observations would be made in the matter.

A paper, "On the Formation of a Local Museum," was read by Mr. Harting [Transactions, ii., 36].

The President, in proposing a vote of thanks to the author, said that he agreed almost entirely with what Mr. Harting had said so well, and he had already given expression to similar ideas on a former occasion. He thought the Society could not be too decided in excluding the proverbial stuffed crocodile and foreign objects of doubtful origin, nor too strongly urge upon its members the advisability of giving a complete and accurate record with every specimen which they might present to the Museum. The best and most useful specimens would be those collected by themselves in their own districts. He thought the Society should restrict the specimens to objects found in Essex, except perhaps objects which might be called educational and which served to illustrate in various ways the flora and fauna of the county. He would draw the line at what were commonly called antiquities. The Essex Archæological Society dealt with these, and he would suggest that, if the Essex Field Club preserved antiquities at all, they should be only such as came fairly within the class called pre-historic. He thought their Museum should be as much as possible educational. It should have two sides; the somewhat deeper scientific aspect represented by having as complete a series as possible of all local animals, plants, fossils, and minerals; but it should also have a popular educational side. For the latter there should be diagrams showing the typical structure of plants and animals, and examples of dissections and other preparations to aid the real student. Great advance had recently been made in the mode of conserving and exhibiting many objects, and when they saw the progress Mr. English had made in preserving *Fungi* and flowering plants, he thought that a collection of plants, &c., preserved by those methods would be a valuable thing in the proposed Museum.

Mr. Robarts and Mr. Fisher Unwin suggested that the Library should be confined to works of scientific, local, or topographical interest. The President fully agreed, and thought the Librarian should be authorised to decline with thanks works which were not of scientific value; but that the Club should accept all books of scientific interest, whether local or not.

Mr. Walker referred to the beautiful drawings and preparations contained in the late Mr. Andrew Murray's collections at the Bethnal Green Museum, as being typical of what they would wish to see in their own Museum.

Mr. Wall, F.G.S., said we had nothing in this country to vie with the Museums of Melbourne and Sydney as educational Museums. At Melbourne Prof. von Müller had arranged a collection which would bear comparison with any Museum in the world for educational value. He quoted his own experience during his travels as emphasising what had been urged with regard to the great value of local Museums, and the knowledge of, and taste for, various branches of Natural History which they were likely to promote.

The next business upon the agenda paper was, "Exhibition and Description of Flint Flakes."—Mr. Worthington Smith, F.L.S., F.R.H.S., &c."

Unfortunately Mr. Smith was detained in London; but he sent a collection of Flakes, and at a short notice the President undertook to fill his place by giving a general idea of the lines of argument which had led them to state positively that there had been a Stone Age. Flint "flakes" and other implements were continually being brought under their notice, and many members of the Club had come to him with questions which showed that they were entirely unaccustomed to that simple mode of interpreting facts which had led to the belief in the existence of a Stone Age in this and in other countries. That a Stone Age had existed was shown by a variety of proofs. The evidence was not obtained from any single specimens, nor was it based upon an isolated set of facts, but there was a consensus of evidence. Mr. Meldola thought that a few general remarks upon this interesting subject might be useful, as serving to prepare the way for those more special papers which they hoped to get from Mr. Worthington Smith and other members of the Club who were doing detailed work in this field.

Passing on to the consideration of the various kinds of evidence, the President first called attention to the peat-bogs of Denmark, in which the data were chronological; there was clear evidence of a succession in time. At a certain depth were found fossil Pines associated with stone implements of undoubted human workmanship. At a later age—a less depth—there were fossil Oaks, with implements of bronze; and at still later date the Beech was found in association with weapons of iron. Thus from one locality they had evidence of the use successively of stone, bronze, and iron. But of course that did not mean that at any given

period the whole of the human inhabitants of Europe were using stone exclusively, at another period nothing but bronze, and at another period only iron. As pointed out by Sir John Lubbock, these ages no doubt overlapped, and stone might have been in use in one country at a period when bronze had found its way into a neighbouring country. The remains found in the peat-bogs simply indicated three successive stages of civilisation in one district, but there was no reason whatever for believing that each stage was absolutely contemporaneous with a corresponding stage throughout the whole of Europe. Then there was evidence of another kind furnished by the well-known refuse-heaps or "kitchen-middens" found on the shores of the Baltic, consisting of great mounds of shells which appear to have been cast away as refuse by the people of the Stone Age. In these heaps were found none but stone implements; they belonged without doubt to the Stone Age, and no metallic weapon of any kind had ever been found in them. Facts of this sort of course went to show that the use of stone preceded that of metal, which required greater skill and knowledge in order to work it, and they further went to support the view that our ancestors were of a more barbarous type than their successors, and not, as is often stated, that man has been degraded from a more civilised state.

The Stone Age had been divided into two periods, the Neolithic or Newer Stone Age, and the Palæolithic or Old Stone Age. The first evidence of man's advent upon the earth, as afforded by these worked flints, according to the generally-received opinion, showed that he appeared about the time of the last glacial epoch which came on at the close of the great Tertiary Period of geologists. Of late years some authorities had stated that worked flints had been found in strata of inter-glacial or possibly of even pre-glacial age. The evidence had been much disputed, but he (the President) was glad to see that Prof. Ramsay, the Director-General of the Geological Survey, in the last edition of his 'Physical Geology and Geography of Great Britain,' had unhesitatingly accepted Mr. S. B. Skertchley's statement that he had found flint implements in brick-earth beneath the Chalky Boulder-Clay near Brandon, in Suffolk. So far as he himself was concerned, the President saw no *à priori* reason for refusing to accept the evidence of man's enormous antiquity—an antiquity which might extend back to pre-glacial times and even as far back as the Miocene Period. The implements of the Old Stone Age were of a much ruder type than those of the Neolithic Period, but that they were both of human workmanship would not for a moment be doubted by anyone who would examine them fairly and intelligently. Palæolithic implements were found in association with animals now extinct, and their enormous antiquity was further proved by the great elevations at which the flints were sometimes found above the existing rivers. By means of diagrams drawn on the black-board, Mr. Meldola then showed the manner in which valleys were hollowed-out by river-action, deposits of alluvium and gravel being left at different elevations

as the denuding action of the river went on, so that the lower beds of alluvium were of course formed much later than the higher beds. The association of flint implements with the remains of extinct Mammalia in the high-level gravels brought them face to face with the most ancient evidence of the existence of man. Whether that period represented the actual appearance of man upon the globe was of course another question. He thought that most probably it did not, because the mere intelligence required to work a flint must have taken ages to develop. M. Boucher de Perthes, in 1847, was among the first to call attention to the occurrence of flint implements associated with remains of the Mammoth in the high-level beds of Abbeville, on the River Somme; and his observation, like many other new observations in Science, was allowed to remain for long unheeded; but the matter had at length been inquired into, and it had gradually become established that the human makers of these Palæolithic weapons were contemporaries of the Mammoth and other extinct animals.

There was yet another class of evidences. In many limestone countries water charged with carbonic acid had eaten away large caves in the limestone. These caves, many of which were probably pre-glacial, had served as storehouses for the *débris* left in remote ages, and these remains had there become cemented up and were waiting to be read as records of the past. In some of these caves the whole chronological data had been preserved; and we had the whole series, from post-Roman to pre-Roman, down to the ages of iron and bronze, and lastly to the Neolithic and Palæolithic Periods. The occurrence in these caves of the same animals that were found in the high-level gravels showed that the caves were also of Palæolithic age. In the South of France, in a cave belonging to a period intermediate between the two Stone Ages, there had been found a fragment of a Mammoth's tusk, with a figure of this animal carved upon it by the hand of Palæolithic man, and also the drawing of a Reindeer on a portion of the antler of this animal, together with other pre-historic works of rude art. A more convincing proof of the co-existence of Man with the Mammoth could not possibly be given. Palæolithic implements were somewhat rare, and were generally found at considerable depths in ancient river gravels; Neolithic implements were much more commonly distributed, and were found either actually on the surface of the ground or at a slight depth beneath it. Their esteemed honorary member, General Pitt-Rivers, had opened some of the ancient hill-forts at Cissbury, near Worthing, Sussex, and there he appeared to have found a flint-implement manufactory, as there were hundreds of implements in all stages of manufacture, and flakes scattered about in profusion. A similar manufactory had been recently discovered near Crayford, in Kent. The conclusion seems to be that these implements had been objects of barter, and that factories had been established at certain places where the chalk had been tunnelled into for the purpose of getting out the flints. Mr. Meldola then explained how worked flakes could be distinguished from merely accidental scalings or fractures, all of them having what is known

as a "bulb of percussion," and illustrated his remarks by specimens taken from those sent by Mr. Worthington Smith which had been found in the area of the British Camp near Ightham, Sevenoaks, Kent.

Mr. Robarts, F.G.S., cautioned the members of the Society against supposing that there was any very distinct line between the Palæolithic and the Neolithic Ages. The Palæolithic implements, which were roughly formed, were so far mixed with the Neolithic, for a reason which he would give later on, that when they found Palæolithic implements they must not conclude—from that, at all events—that their age was very great. Implements which were not polished, which were little more than flakes, would naturally be made by hunters or by people who wanted implements in a hurry. And often they might expect that, in the summer season, when a hunter came across the then mainland—now the German Ocean—into Great Britain, he would leave a small deposit of implements, which, when found, might be considered Palæolithic. And they must not consider that Neolithic implements were all done with after bronze was introduced. Bronze would have been an article of luxury and used by the chiefs, whereas the rank and file would not have been able to use bronze weapons, but must have been content with stone ones. In all probability stone implements were used even long after the introduction of iron. Then again we had almost contemporaneous evidence of the manufacture of stone implements—at all events they were manufactured in America as late as the middle of the 16th century. Flint implements were then made by the Indians at Montreal, whereas a couple of hundred years afterwards they were utterly unknown, and when dug up—had it not been known by certain memoranda made by a voyager that there had been that camp of Indians there—they might have been put down to a period hundreds or even thousands of years previously. Another point to be taken into consideration was this: it must not be taken that the engravings on the bones were always engravings of contemporaneous animals. There was considerable probability that they were of the nature of totems which descended from father to son, as they did among the American Indians; and there was a probability that, instead of these figures being pictorial representations of animals living at the time—although they would have been that in the first place—they were simply the designs of chiefs, and might thus have kept to the Mammoth, though the Mammoth had then no existence. He would add to the manufactories the President had named one which he had not mentioned: the holes known as Grimes's Graves, which were in all probability made to get into good strata of flints—flints which would work easily. As supporting the theory that flint implements were objects of barter, Mr. Robarts mentioned that they were found in considerable numbers in places destitute of the stone from which they were made; and certain stones had been carried all over Europe, and might be traced almost to one particular spot where the factory was. As to the question of difficulty in distinguishing the worked flints, he said that they might get doubtful flakes and be uncertain

about them; but directly they got a manufactured one the signs would be so clear that there could be no difficulty in saying whether it was natural or artificial. Mr. Robarts concluded by stating that he had found what he believed to be a very good flake in the brickfield at Honey Lane, and he thought that if the members of the Society would work that field they might obtain good results.

Mr. Henry Walker said, if he understood the drift of Mr. Robarts's remarks at the commencement, it was really to minimise the antiquity of man.

Mr. Robarts—Not at all.

Mr. Walker said he thought he detected in the speaker's reference to the Hochelaga implements of the 16th century a following of the line which Professor Dawson had taken since he had become a "reconciler." But a Stone Age was to be found in our own days without going back two hundred years. He held that there was an enormous gap between the Palæolithic and Neolithic Ages in Western Europe, as evidenced by the excavation of valleys and other great physical changes, and especially by the great change in the fauna. With regard to the social condition of Palæolithic man, he thought it was a great mistake to look upon him as a savage. Those who had read Darwin's 'Voyage of the Beagle' would recollect the author's description of certain native tribes in South America who might properly be so designated. They wore no clothing, had no habitations, they fed on worms, and lay down on the bare ground in all weathers. Now Palæolithic man was more than this. He was at least a manufacturer; he made implements, and for all we know to the contrary might have had a social and tribal polity. He had left no structures behind him, and his habitations were probably wattles. The country had been submerged since the time of Palæolithic man, as was shown by the beds of alluvial gravel which overlie the beds containing the old Mammalia. It was remarkable how the once-despised gravel had come to the front lately in geological enquiries. Everywhere now the talk was about the gravels, their age, and conditions of deposit. The reason why the gravels were found in the valleys was obvious. In times of flood and submergence everything on the surface was liable to be washed down to the lower levels, and hence the valleys had become the repositories and museums of the drift of the landscape. They must make up their minds to hear more and more of the gravels and their contents, for they would long continue to be the geological topic of the day. With regard to the so-called "Dane's holes," it was agreed by the best observers that they were artificially made, and had served as places of refuge, perhaps when the old Norse pirates were ravaging the shores of the Thames.

Mr. Robarts explained that he did not wish to throw any doubt upon the great age of man. On the contrary, he believed man was here at the Glacial epoch. His remarks went only to the manner in which the different periods overlapped each other.

Mr. Meldola—If he were here at the Glacial epoch he must have been here at least two hundred and forty thousand years ago. (Laughter.)

Votes of thanks were passed to Mr. Worthington Smith for his gift of the series of "flakes" to the Museum, and to Mr. Meldola for his interesting impromptu lecture. The meeting then resolved itself into the usual Conversazione, at which the Rev. F. A. Walker sent for exhibition some specimens of "banded flints" from the chalk formation at Christchurch, Hants; and Mr. R. M. Christy sent some flint implements, including eight from Canada, one from the Bartlow Hills, three more or less perfect implements from Cissbury, one from South Downs, and a number of curious flint chips from Cissbury Hill, where similar ones may be obtained by the bushel; also a few gun-flints, to show that the manufacture of flint had lasted to these days.

Monday, May 30th, 1881, and following Days.

Report on the Club's Exploration of Ambresbury Banks, Epping Forest.

At the Field Meeting held on July 3rd, 1880, the President suggested that the scientific exploration of the two ancient earth-works, known as Ambresbury Banks and the Loughton Camp, would be a fitting and worthy task for the Club to undertake. The suggestion was warmly received by the members present, and General Pitt-Rivers very readily promised his valuable aid and advice in the matter. As detailed in the Report of the Ordinary Meeting on October 30th, 1880, permission to make the necessary excavations was granted to the Club by the Epping Forest Committee of the Corporation of London, and under date October 12th a circular to the members was issued by the Honorary Secretary, making a strong appeal for funds to carry on the works, the cost of which would be too great to be defrayed out of the ordinary income of the Society. In response to that appeal the following sums were subscribed by the members of the Club named:—

Forest Camps Exploration Fund.

Subscriptions, 1880 and 1881.

	£	*s.*	*d.*		£	*s.*	*d.*
Brady, Sir Antonio	1	1	0	Fawcett, W.	0	10	6
Burney, George	1	1	0	Fitch, E. A.	1	1	0
Buxton, E. N.	1	0	0	Gardner, Prof.	0	10	6
Buxton, Sir Fowell	1	0	0	Godwin, George J.	0	10	6
Buxton, T. F. V.	1	0	0	Goss, Herbert	1	1	0
Carrington, J. T.	1	1	0	Gould, F. C.	0	10	0
Christy, R. M.	0	10	6	Grut, Ferdinand	1	1	0
Cole, William	1	1	0	Harcourt, G. C.	0	5	0
Copland, Mrs.	0	5	0	Heathfield, E.	0	10	0
Copland, P.	1	1	0	Hore, J. P.	1	1	0
Copland, P. F.	0	5	0	Howard, W. D.	1	1	0
Crouch, Walter	0	10	6	Jervoise, Sir J. C.	1	1	0
Darwin, Charles	1	1	0	Johnston, Andrew	1	1	0
Dunning, J. W.	1	1	0	Jones, D. B.	0	5	0

	£	*s.*	*d.*
Kelly, Alexander	1	1	0
Letchford, R.	1	1	0
Lockyer, Alfred	0	10	6
Lockyer, G. H.	0	5	0
Meldola, R.	1	3	0
Melles, William	2	0	0
Owen, John	0	10	6
Pitt-Rivers, General	5	0	0
Ramsden, Hildebrand	1	1	0
Robarts, N. F.	0	10	0
Saul, George T.	1	1	0
Smith, W. G. S.	0	10	6
Snell, E. A.	0	10	6
Spicer, Albert.	1	1	0
Thomas, Charles	1	1	0
Tozer, A. H.	0	10	6
Trimmer, Dr.	1	1	0
Unwin, Fisher	0	10	0
Walker, Henry	1	1	0
Wheeler, E.	1	1	0
Wilson, Rev. W. L.	1	1	0
Winstone, B.	1	1	0
Yeates, Mrs.	0	5	0
Total	£46	3	0

Sufficient funds having been subscribed for the investigation of one Camp, at the Council and Ordinary Meetings held on February 26th the following members were nominated as a Committee to conduct and supervise the operations:—The Officers *ex officio*, Mr. D'Oyley (Honorary Surveyor), Messrs. H. A. Cole, J. English, N. F. Robarts, Charles Thomas, T. Fisher Unwin, and F. H. Varley; and subsequently Mr. A. Tozer and Rev. W. Linton Wilson joined the Committee. It was decided to begin with Ambresbury Banks; the contract for the work was taken by Mr. Charles Cuthbert, of Loughton; and very carefully made plans and working sections were provided by the kind exertions of our Honorary Surveyor.

On the morning of May 30th the contractor and workmen were duly on the ground, together with our directors General Pitt-Rivers and Mr. D'Oyley, and several members of the Committee. A part of the rampart to the left-hand side entering the Camp from the Epping Road had been staked out, but it was found that excavations there would necessitate the removal of at least one large tree; and a site to the right of the entrance free from trees of any size was finally chosen. The ground was speedily staked-out by the Surveyor, the bushes cleared away, and the turf peeled off. Then commenced the careful work which demanded the close attention of the explorers for eight or nine days. The earth was systematically dug out in "spits" by the workmen and thrown into the barrows or cart, where each spadeful underwent a rigorous examination by the several members of the Committee on "search duty." It was found impossible to use the sieve in consequence of the clayey and agglutinative nature of much of the soil, and small geological hammers and extemporised spades were soon busily employed in turning over and over the *débris* of the ancient rampart. But some of the searchers found that their hands were really the best instruments in such close work, and several of the "finds" were the result of persevering digital exercises. Throughout, the workmen were very careful and watchful, faithfully carrying out the directions given to them. The plan of operations and theory of the work are set forth in the Report [Transactions, ii., 55], and need not be recapitulated. As evidence of the care taken, and as a slight

acknowledgment of their freely-rendered services, the names of those acting as watchers and directors of the work, with the dates of their attendances, are here given :—

Monday, May 30th.—General Pitt-Rivers, Messrs. D'Oyley, Meldola, H. A. Cole, and W. Cole.

Tuesday, May 31st.—Messrs. Meldola, D'Oyley, A. Lockyer, H. A. Cole, and W. Cole.

Wednesday, June 1st.—Messrs. Meldola, D'Oyley, F. H. Varley, H. A. Cole, and W. Cole.

Thursday, June 2nd.—Messrs. Meldola, H. J. Barnes, H. A. Cole, and W. Cole.

Friday, June 3rd.—Rev. W. Linton Wilson, Messrs. D'Oyley, Meldola, H. A. Cole, and W. Cole.

Saturday, June 4th.—Messrs. Robarts, Fisher Unwin, Meldola, D'Oyley, and W. Cole.

Monday, June 6th. — General Pitt-Rivers, Messrs. Fisher Unwin, Meldola, D'Oyley, H. A. Cole, and W. Cole.

Tuesday, June 7th.—Messrs. H. A. Cole and W. Cole.

Wednesday, June 8th.—Messrs. D'Oyley, W. S. Hodge, H. A. Cole, and W. Cole.

The excavations were watched at night by two of the Forest Keepers, Mr. Luffman and Mr. Butt (permission being kindly given by our member, Captain M'Kenzie, Superintendent of the Forest), in order to protect us from unwelcome visitors; but their office was almost a sinecure, as no interference with the work was attempted.

As the investigation progressed it became more interesting. We quickly came upon vestiges of man, and evidence of the use of fire in the shape of bits of charcoal and burnt clay. Early on Wednesday morning a considerable deposit of this kind was unearthed near the spot marked "Charcoal" on the section (Plate IV.)—quite a quantity of charcoal, burnt clay, and calcined stones, evidently the remains of a long-continued fire. Near this spot a piece of rim of a pot and a flint flake were turned up. We were soon able to distinguish the "old surface-line" or original undisturbed soil of the Forest, the exact limits of which it was so necessary to define. The artificial character of the soil composing the rampart was often very noticeable, the successive layers of deposited earth being readily distinguished; Mr. D'Oyley has indicated this non-natural stratification by shadings on his section. Great care was exercised in making out the true section of the ditch or fosse, the determination of its exact construction being considered by General Pitt-Rivers a matter of much importance.

In the report of the investigation in the 'Transactions' but a passing reference has been made to the scanty literature of this earthwork. The Editor has been enabled to find but very few references to it. It was the custom to ascribe it to the Romans, but local tradition perhaps more justly connected it with the Amazonian heroine, Queen Bodug, and the

scenes of the latest struggles of the British against invasion and outrage. The best account of it, previous to Mr. Cowper's papers referred to below, was given by Gough in his edition of Camden's 'Britannia' (1789), vol. ii., 49, he deriving his information mainly from a local antiquary, Mr. Lethieullier (of Wanstead?). Speaking of Copt Hall, he says:—"Just without the park, on the south-east side of the London Road, is an oval Camp called Ambresbury Banks, and probably British.—See plan of it, Plate I., fig. 4." He then quotes an interesting MS. letter from Lethieullier, as follows:—"This intrenchment is now entirely overgrown with old oaks and hornbeams. It was formerly in the very heart of the Forest, and no road near it, till the present turnpike road from London to Epping was made almost within the memory of man, which now runs within a hundred yards of it; but the intrenchment cannot be perceived from thence by reason of the wood that covers it. It is of an irregular figure, rather longest from east to west, and on a gentle declivity to the south-east. It contains near twelve acres, and is surrounded by a ditch and a high bank much worn down by time, though where there are angles they are very bold and high. There are no regular openings, like gateways or entrances, only two places where the bank has been cut through, and the ditch filled up very lately in order to make a straight road from Debden Green to Epping Market. The boundary between the parishes of Waltham and Epping runs exactly through the middle of this intrenchment, whether carried so casually by the first setters-out of those boundaries, or on purpose, as it was then a remarkable spot of ground, I leave to better judgments to conjecture. As I can find no reason to attribute this intrenchment either to the Romans, Saxons, or Danes, I cannot help concluding it to have been a British Oppidum, and perhaps it has some relation to other remains of that people which are discoverable in our Forest."

The above account of Mr. Lethieullier's is probably the basis of all that has been said about the Camp by local historians. A rough plan of the Camp is given in Mrs. Ogborne's 'History of Essex' (1814), apparently a copy from the one in the 'Britannia'; and Morant, although his history was published in 1768, appears to have derived his information also from Lethieullier. Mr. Cowper's papers were called forth by his lighting upon the "Loughton Camp" in the year 1872. His first paper entitled 'Notes on an Entrenched Camp in Epping Forest' was read at the Meeting of the Royal Archæological Institute, November 5th, 1875 (Arch. Journal, vol. xxxiii.); a second paper was read at the Colchester Meeting of the Institute in 1876, and is published in the same volume. Subsequently another paper was published for Mr. Cowper by the Committee of the Epping Forest Fund (1876), with lithographed plans by Mr. D'Oyley; and in 'Cassell's Family Magazine,' vol. iii. (1877), page 153, the same writer gives a very interesting *résumé* of his observations. These papers are well worthy of attention, and contain almost all the reliable information about the Forest Camps extant previous to the Club's explorations.

In the attempt to connect the Ambresbury earthwork with the last exploits of Queen Boadicea, our authors have been much puzzled by the well-known story in 'Tacitus,' which locates the battle between Seutonius and the British in an open plain, closed in the rear by a forest—a station wisely chosen by the Roman General to guard against ambuscades. In a note by Gough on the passage in the Roman historian, he says (Gough's 'Camden,' vol. i., xxxviii., *note*):—"Mr. Morant, upon comparing all accounts and circumstances, persuades himself that this battle was fought near Epping, by the side of Copthall Park, where is now a fine bank called Ambresbank, enclosing about eleven acres ('Hist. of Essex,' i., 46—'Colchester,' p. 23, *note* z). But this obvious circumstance of the action being in a *plain*, and all this part of the country at this time most probably forest, seems to make directly against him. At the same time it must be owned that the name of the Camp gives it to the Britains. It might have been an *oppidum;* but Tacitus's account gives no reason to think they threw up any work at this juncture. The want of barrows is an argument that so great a slaughter could hardly have happened here." Recalling this opinion of the last century antiquary, it is a curious fact that our excavations afforded not the slightest evidence of the site, at the period of the construction of the Camp, having been woodland. The old "surface-line," which was so carefully watched and studied, was composed of a light-coloured and very sandy clay, such as may be met with on the surface of the open heathy ground in the forest. We met with no indications of decayed stumps of trees or vegetable humus. Our workmen at once noticed the similarity of the soil at the base-line and the surface-soil of the open forest. The woodland at and around the Camp is evidently very modern, and, without giving too-ready credence to the theories of Morant and others which connect the spot with "the last stern battle-plain" of the despairing Queen, it may be allowable to suggest that the side and surroundings of the Camp in the Roman era were probably an open expanse of moor or heathland. Moreover, it seems unlikely that a Camp would have been thrown up in a dense forest, which, by affording cover to an approaching foe, would vitiate in great measure the main end in view—the security and isolation of the defenders.

Bearing in mind the results of our explorations, it is hardly necessary to throw another stone at the exploded hypothesis that Ambresbury was a Roman station; but it should be noted that the high road which at present runs by the Camp to Epping is comparatively a very modern one. It was possibly originally a mere forest track leading to the little hamlet of Epping Street, the main "ancient way from Harlow to London being from the corner of Wintry Wood, where the turnpike stands, across the forest to Abridge." The road as it at present exists is certainly not older than the beginning of the 16th century, for in 1518 Master John Baker, a worthy mercer of Epping, bequeathed a charge upon certain of his estates for the repairing of the way. "This," says Morant, "seems to have been for the sake of Epping Street, to induce travellers to go that way, and

the intention was answered." The road was therefore not founded on a Roman one, and the Camp in early days was hidden away in the depths of the Forest (using the word "Forest" in its legal sense, of a wild unreclaimed tract of country). We are told that it was an instinct with the Romans in the erection of their forts to attend closely to means of rapid access and intercommunication. Where Roman Camps or settlements have been, there are the remains of the Roman roads, straight, useful, and ugly But the British loved to hide their Camps and Kraals in the midst of the wild moorland, morass, or woodland of primeval England, and cared for no better roads than mere forest-paths, curving and straying as the oaks permitted, or as open glade or heath tempted—bad roads, perhaps, but to this day charming and beautiful!

Although the occupation of watching the gradual and systematic removal of the rampart was ofttimes felt to be somewhat monotonous and tedious, yet the weather during the greater part of the time was so balmy, and the fresh spring woods so cheerful and pleasant, that the members on duty felt themselves amply repaid for their enforced sojournings in the "house of the forest," with its pillared arches, shadowy aisles, and arabesques of leaves and flowers. In the early mornings, especially, as we rode down from Loughton at five o'clock to meet the workmen at the Camp, the quiet beauties of the "merry green woods" sank deeply into our minds; the sweet blossoming hawthorns bordering the Epping Road, snowy white when newly petaled, but flushing with a lovely pink as the myriads of tiny roses hastened to decay, were surely never seen in greater glory. Friends from time to time strolled over to watch our proceedings, and to share our primitive meals at the "Wake Arms"; and our entomologists took advantage of the sunshine to organise hunts in the woods about the Camp, meeting with a fair amount of success. Once a swarm of bees settled on a bush not far from the scene of operations, and as it was "a swarm in May" and therefore worth "a load of hay," a neighbouring cottager quickly hived the little emigrants with all the accustomed ritual. A few fossils were obtained by breaking the flints so abundantly turned up with the soil, and some of the nodules when broken were remarkable for their banded and agate-like colours. Good herds of the forest deer were espied more than once as we wended our way home through the woodland rides in the gloaming of the June evenings, and on the whole we agreed that, with fine weather, camp exploration in an ancient forest was an employment by no means unenjoyable.

Our learned conductor deeming it necessary that the levels of the ground in and around the Camp should be noted on the plan, two days (July 26th and 28th) were given to this further work by Mr. D'Oyley, assisted by Messrs. H. A. and W. Cole and our coachman. Captain McKenzie very courteously allowed us the use of his surveying instruments, Mr. D'Oyley's being then in service in another part of the country. As intimated in the 'Transactions,' the results of this additional survey are recorded on Plate III.

Saturday, July 25th, 1881.—Field Meeting and Ordinary Meeting.

This afternoon, by the kind invitation of the Rev. W. Linton Wilson, M.A. (Vice-President), the Club held a Field Meeting at Chigwell. During the morning the rain poured heavily; but the weather cleared somewhat in the afternoon, and only an occasional shower interfered with the comfort of the visitors. Some forty odd members and friends assembled at the Chigwell Lane Station on the arrival of the 2.13 train, some coming in carriages by road from Buckhurst Hill and Woodford. Among the company was Mr. Fletcher, President of the Ottawa (Canada) Field Club, who was warmly welcomed. The main objects of the meeting were the collection of microscopical and botanical specimens; and members were requested to bring collecting apparatus with them, and to forward their microscopes to "Oakhurst," Mr. Wilson's residence, which was to be the goal of the afternoon's ramble. But unfortunately the rain had been so heavy, that it was impossible to make incursions in the fields and coppices with any reasonable degree of facility or pleasure, and very little could be done in the way of collecting. Our members, Mr. Oxley, F.R.M.S., and Mr. Letchford, F.R.M.S., and several others managed to conduct some researches after *Infusoria* successfully in the back-waters of the Roding and in some ponds near Chigwell, and they afterwards exhibited their spoils at the evening meeting. The bulk of the party were perforce obliged to content themselves with a pleasant social stroll through the lanes to the old church, discussing as they went the *flora* of the banks and hedges, and recalling memories of rambles when bright skies and drier surfaces had tempted our collectors into fresh fields and pastures new. But in spite of these drawbacks the walk was a pleasant one, and at the old church of St. Mary's the party was reinforced by Mr. Saville Kent and Mr. T. Fisher Unwin, who acted as our conductors. The church had been thrown open for inspection by the kindness of the Vicar, the Rev. W. S. Meadows. Mr. Unwin read a most interesting paper on the ancient and modern history of Chigwell and neighbouring hamlets, commencing by referring to our great novelist's connection with the village:—"Chigwell, my dear fellow, is the greatest place in the world. Name your day for going. Such a delicious old inn opposite the churchyard—such a lovely ride—such beautiful forest scenery—such an out-of-the-way, rural place—such a sexton! I say again name your day." Thus wrote Charles Dickens forty years ago last 25th of March to his friend and biographer, John Forster; and Forster adds that—"The day was named at once; and the whitest of stones marks it now in sorrowful memory. His promise was exceeded by our enjoyment, and his delight in the double recognition of himself and of Barnaby, by the landlord of the nice old inn, far exceeded any pride he would have taken in what the world thinks the highest sort of honour." Most of those gathered there that day would re-echo Dickens's verdict on the charms of Chigwell, and Chigwell people might well be proud of their association with the author

of 'Barnaby Rudge.' Forty years had gone by, and yet the village could have little changed since Dickens first saw it. It remained an illustration, and a most pleasing one, of an old country hamlet, the like of which Washington Irving and Miss Mitford described so charmingly in their books, and Mr. Caldecott drew with such graphic beauty; yet not ten miles from London! Search the city round in double the radius they would not find its equal. The village gives its name to a parish in the Hundred of Ongar, and in years gone by was contained in the great forest of Essex, when the forests now known as Epping and Hainhault met on the banks of the Roding and formed one great woodland. The speaker examined the derivation of the name (which is spelled in many ways in old records), tracing it to the two Saxon words "eing" and "well" or "Kings-well." Of the seven manors comprised in the parish, two, Chigwell and Woolston, according to Domesday Book, were royal demesnes, Earl Harold holding them of Edward the Confessor; hence the first syllable. To find the origin of the second they must go to the hamlet of Chigwell Row; and in an old MS. about the year 1746 he read—"If any credit is to be given to ancient report, we may reasonably conclude that the salutary effect of this water was well known ages ago, the place where it issued out being signified with the name of King's Well—for Chigwell is only a corruption of King's Well, C and Ch in the Saxon language having the power of K, but by losing that power and dropping the N the name was ridiculously (*sic*) converted into Chig." . . . . "This much injured tho' useful water is found issuing out of the declivity out of the rising hill on the south side of the wind-mill, in the Wood or Forest." . . . . "This is supposed to be the old well, and in all probability was so, as the vestiges of some kind of building appear at this day. Another opening is discovered to ye west of this hill, and a third well has been lately dug on the north side of the same hill, in a field behind the house called Whitehall, which proves to be more strongly impregnated with mineral qualities than either of the other two." Also Dr. Frewin, born at Chigwell Row, and celebrated in his day, says—"This county, especially the hilly parts of it, has been remarkable for the variety of medicinal waters, which have been taken notice of from time to time by several able physicians and historians; and upon a strict examination I find that the water which vents itself at several openings at Chigwell is as much deserving of notice as any in the county, and I doubt not will be found as efficacious in many chronical diseases as any in the kingdom." Here, then, they had evidence of the existence of these wells early in the last century. But the name of the village carried them back to Saxon times, and it is not impossible that our Roman conquerors may have visited it. The Romans understood the value of mineral springs and the bath, and at several of our English springs their presence has been established. In Essex they had plenty of evidence of their occupation. In their own neighbourhood, at Leyton, and in the town of Ongar, and even within the borders of Chigwell parish, remains had been found

supposed by some to be of Roman origin. In these details Mr. Unwin thought they had sufficient evidence of the origin of the name of "our village."

The Church dedicated to St. Mary is of great age. But the first notice of it the speaker could find was in the reign of Edward III., when from 1329 to 1400 the presentation was in the gift of the families of Goldingham, Lords Bourchier and Dorwood.

In 1474, during the reign of Edward IV., the rectory was united to the prebend of St. Pancras in St. Paul's. But prior to these dates, some chapel, chantry, or monk's cell most likely existed. Morant, in his 'History of Essex,' dated 1768, says—"St. Mary's consists of a body and a north aisle. Both church and chancel are leaded, and the aisle tyled. The east end of this aisle is called the little chancel, being the burial place of the ancient family of Scott. The belfry is of timber, with a spire shingled, and in it are five bells."

Looking at St. Mary's to-day, we are struck more by its picturesque position, the rural charms surrounding it, and the unique avenues of yew which lead up to its doors; these groves of yew reminding us of the days long gone by, when custom planted them in the churchyards of our villages so as to give a good supply of wood to the yeomen to make their bows to serve them in warfare or chase. In the records searched Mr. Unwin had found no mention of these avenues, but in a picture he had seen, dated 1769, they were represented as full-grown trees, forming an avenue. The general appearance of the building reminded them of many of their Essex churches, such as Lambourne and Ongar. The most interesting architectural feature is the fine south door, with the zigzag or chevron mouldings of the Norman period. The church is rich in monuments and hatchments, to the memory of many of the old residents, Lords of Manors and Donors of Bequests. One of the quaintest is to the memory of Thomas Coleshill, who died 1595, and it tells us he was servant to Edward VI. and Queens Mary and Elizabeth; it depicts him kneeling at a stand with books, the lady with her two daughters behind her in the same attitude, dressed with large ruffs and lappeted head-dresses, with two Latin inscriptions. The magnificent brass to the memory of Bishop Harsnett, now in the aisle, is most interesting. Till about fifty years ago it was fixed against the north side of the chancel; originally, no doubt, it would have been placed on the floor. We read that he was buried at Chigwell, by his own desire, at the foot of Thomazine his wife. The inscription in Latin is as follows:—"Here lieth Samuel Harsnett, formerly vicar of this church. First the unworthy Bishop of Chichester, then the more unworthy Bishop of Norwich, at last the very unworthy Archbishop of York, who died on the 25th day of May, in the year of our Lord, 1631. Which very epitaph that most reverend prelate, out of his excessive humility, ordered by his will to be inscribed to his memory." The monument represents him in a mitre, rich cope, rochet and chimere, holding a pastoral staff; and Mr. Unwin believed it to

be the latest representation of the canonical vestments on an English brass.

The lecturer then entered into some interesting details of the history of the manors and mansions contained in the parish, which would be out of our scope to reproduce; * and went on to say that Chigwell, although it could not claim to be the birth-place of any men of world-wide fame, might yet be proud of several who lived and worked in the village, and who must in their days have influenced its life and character. Of these Samuel Harsnett, Archbishop of York, must be of most local interest—born in 1561, in St. Botolph's Street, Colchester, and the son of a baker, he was, therefore, an Essex man. Getting some learning, how the speaker knew not, he was sent to Cambridge; and in 1597 he became Vicar of Chigwell, and successively of other parishes in the county; also Archdeacon of Essex, Bishop of Chichester, and later of Norwich. On the 13th of April, 1629, he founded the two Free Schools, one called the Grammar, the other the English school. His regulations for the schools are particular and quaint; for instance, the lads are "to read the ancient Greek and Latin poets, but no novelties nor conceited modern writers"; and again, "it is expressly provided that the master be no puffer of tobacco." The schools were founded for the use of Chigwell and neighbouring parishes, and have no doubt sent many good men and true into the world. But their most famous scholar was William Penn, founder of Pennsylvania: Penn was born October 14th, 1644, on Tower Hill, and his childhood from about 1650 to 1655 was spent at Wanstead. He must have entered the school when nearly ten years of age; how long he remained in it the speaker could find no trace. Surely Chigwell and Essex might claim to have had their influence in forming the character and directing the future life of the great Quaker Colonist. That year, almost that month, 200 years ago, the New England Colony was founded. Their American cousins were about to celebrate its bi-centenary, and it was well for them at Chigwell to recall it to their remembrance.

Chigwell's best known Rector, Mr. Unwin thought, was the Rev. William Paley. In 1794 the Bishop of London presented him with the Prebend of St. Pancras, which included the Rectory of Chigwell. The same year he published his well-known work, 'A View of the Evidences of Christianity'; that, with his other famous books, 'Horæ Paulinæ' and 'Natural Theology' were still read and used as text-books in schools. Before Paley, in point of date, we find John Rogers had the Rectory conferred on him in August, 1551. Previously, whilst Chaplain at Antwerp, he assisted Tyndale and Coverdale in making the first translation of the Bible into English. Whilst Rector of Chigwell, during Queen Mary's reign, he was burnt at Smithfield, at the instigation of Bishop Bonner, on February

* The full text of Mr. Unwin's paper was given in the 'Essex Times' for Friday, July 1st, 1881, to which we beg to refer our readers; and the Editor is glad to acknowledge his indebtedness to the excellent reports of our meetings contained in that newspaper.—Ed.

the 4th, 1555, for his attachment to the Reformed Religion. At the stake pardon was offered him if he would recant; but he heroically refused, and history told them, "The fire was put under him, and when it had taken hold of both his legs and shoulders, he as feeling no smart washt his hands in the flame, as tho' it had been in cold water, and after lifting up his hands to Heaven, not removing the same until such time as the devouring fire had consumed them, most mildly this happy martyr yielded up his spirit into the hands of his heavenly Father." As another illustration of church history in Chigwell, they might remember Dr. Emmanuel Utie as Rector. The living was sequestered by order of Parliament, on the 12th of July, 1643, the charge against him being for that he hath affirmed "that there hath beene no true religion in England these forty years, and that he loved the Pope with all his heart," and "that if the devil himself would have holy orders put upon him, he would be inspired of the Holy Ghost, &c." Mr. Unwin regretted that he could find but little record of the ladies in Chigwell; one, however, he could not forget, *viz.*, Mrs. Joan Simpson (a lady who took in washing, he was told); in 1357 she left funds in Chigwell, the proceeds of which were to be applied to keeping up the footpath from Abridge to Winn Bridge, Snakes Lane; to this lady, those who have to tramp that road must be ever grateful.

Mr. Unwin said he had told the story of Chigwell, as far as he had time to make research and jot down what he could learn. He thought that for a rural village it might stand by any other in the county, at least for interesting associations. In a few sentences at the close of his paper Mr. Unwin referred to some resemblances between the names of the characters in 'Barnaby Rudge' and existing names in Chigwell; and pointed out that the King's Head at Chigwell was really Dickens's "Maypole," the name being transferred by him from the Inn at Chigwell Row. Opposite the latter Inn there used to stand a post, as to the nature of which Mr. Unwin stated that he had once made inquiry of a labourer, who at once asserted it to be a maypole. "I did not deny it," said Mr. Unwin, "but I doubted it": and he proceeded to say that it was certainly not a maypole, but a whipping-post, or part of a pillory. It had since been moved, but he did not know by whom. The assertion that Queen Elizabeth slept at the "King's Head"—in the oak-panelled room, the "Chester room"—Mr. Unwin deemed at least probable. The house was built in the time of Henry the Eighth, and as they knew that Queen Elizabeth had hunting-lodges in the neighbourhood he considered it very likely that, if she had not slept she had at any rate paused there to taste the ale or the sack. It was also added that the earliest date in the existing register of the church is 1555.

Mr. A. Lister, F.L.S., and the President having thanked the author for his interesting paper, a short walk across the fields (still somewhat damp from the recent rains) led the members of the party to Oakhurst, where they were warmly welcomed by Mr. and Mrs. Wilson. A large collection

of engravings, water-colour drawings, &c., were there shown by Mr. Unwin, to illustrate his remarks at the church. They all related to the scenes and mansions in the neighbourhood of Chigwell, and included two or three of the magnificent Fairlop Oak to which the eccentric bookmaker, John Day—the author of 'Sandford and Merton,' by the bye—paid so many pilgrimages. One of them was very curious, being a lithograph on India-paper and dated 1811—some half-dozen years earlier than the date at which Mr. Ackermann introduced the art from Germany into England, where, however, it had partially become known before Ackermann made its employment general. Mr. Unwin's portfolio also contained a number of old maps of Essex, and old coaching road maps, in which the existence of "a smith's shop" was always carefully denoted. One of the maps of Essex was a German map of about the year 1600. On the back of it was part of the account of Essex, in German, and it was curious to note the geographer's description of Leyton as at that time a small village, five miles from London, and consisting of a few houses strewed here and there. Mr. Oxley, Mr. Letchford, and Mr. Saville Kent showed several forms of microscopic life under the microscope, being the results of the various "dippings" taken during the afternoon; but the finds were meagre, compared with the hauls to be expected at the hands of these experienced pond-hunters on favourable occasions. The specimens exhibited, however, served to illustrate several points in Mr. Kent's paper.

After tea an Ordinary Meeting (the seventeenth) was held, the President in the chair. The following were elected members of the Club:—Miss Jessie Combs, Prof. Gardner, M.A., F.S.A. (Disney Professor of Archæology, Cambridge), Rev. E. Stanway Jackson, W. T. Latter, Mus. B., R.A.M., Mrs. Meldola, G. R. Noble, G. T. Read, W. J. Clumes Ross, B. Sc., Henry Stear, M.R.C.S., Griffiths Smith, F.R.G.S., E. T. Stringer, George Unwin, P. W. Wall, M. Inst. C. E., F.G.S., T. Westhorp, Mrs. Lewis Winter, and Rev. A. B. Bingham Wright, M.A.

Mr. Saville Kent then read his paper entitled, "Infusoria: What are they? Their Collection and Investigation" [Transactions, ii., 44]. The paper was amply illustrated by figures of the various forms noticed, and a hearty vote of thanks was given to the author by acclamation. A short discussion ensued on some points springing out of the paper, in which the President, Mr. Henry Walker, and the author took part.

The President announced, amid much applause, that the work of excavation at Ambresbury Banks had been performed, and entered into some details of the results obtained. He then said that he had a very pleasing duty to perform, and that was to call upon the members of the Club to return their very warmest thanks to their excellent Vice-President, the Rev. W. Linton Wilson, and to Mrs. Wilson, for their very hospitable and kind reception of the Society that afternoon. (Loud cheers.)

The Rev. W. Linton Wilson said that he was sure the members of the Club already knew that it was his and Mrs. Wilson's greatest pleasure to receive them that day. He concluded by saying that, seeing Mr.

English leave, he had gone after him, and found that he had a box in his pocket—Mr. English was never without a box—(laughter)—and he had it there. It contained—preserved by Mr. English's wonderful method—a specimen of the Bird's-nest Orchis (*Neottia nidus-avis*) from Epping Forest, and some plants of the Water Crowfoot, concerning which Mr. English communicated the following note:—

"I have a little incident to bring before you, relating to a condition or adaptation of plant-life. The fact has in all probability been observed before, although not generally known, but may be of interest to the young botanist.

"The usual habitat of the Water-Crowfoot (*Ranunculus aquatilis*) is, as its name implies, in pools of water, where its moss-like foliage grows submerged during the greater part of the year. In the spring it grows up to the surface of the water, produces its lobed floating leaves, white flowers, and perfects its head or fruit of beaked achenes. This is the normal condition of the plant. But in a dry season, such as we have just passed through, the pools of water often partially dry up, depriving the crowfoots of the necessary conditions for the development of their secondary lobed floating leaves. Under these circumstances, however, the plants frequently produce flowers and fruit springing direct from the moss-like submerged foliage, an incident which never happens when the Batrachian *Ranunculi* are growing in their usual stations surrounded by water. When heavy rains occur, the specimens begin to throw up their lobed leaves, and rapidly assume the normal characters of the species. I exhibit specimens showing the variations above described."

The President said he was sure they would welcome short notes like that of Mr. English's with great pleasure, especially when accompanied, as that was, with specimens of the objects described. The abnormal condition pointed out appeared to be of considerable interest. He then asked the Club to record its thanks to Mr. Fisher Unwin for the very able paper read that afternoon.

Mr. Unwin, in acknowledging the hearty vote of thanks accorded, said it had been a pleasure to him to write the paper at the request of their Secretary. He thought that a society which had its head-quarters in the parish of Chigwell, and was visiting the village of Chigwell, ought to have the history of the place told. He regretted that he had so short a time, that it was necessarily a meagre epitome. He trusted that the members would look it up for themselves, for there was a great deal yet to be told, and he would be glad to have information sent to him. He thought the history of Buckhurst Hill might be worked at with advantage.

Mr. Fletcher, President of the Ottawa (Canada) Field Club, thanked the Club for the welcome which it had extended to himself during his stay in the old country, and the President having appropriately replied, the proceedings of a very pleasant meeting—despite the dulness of the weather—came to an end.

THURSDAY, JULY 21ST, 1881.—FIELD MEETING.

A *réunion* of the Club was held on this day in Epping Forest, for the purpose of meeting the members of the Hertfordshire Natural History Society, and showing them some of the most interesting features of the Essex woodlands. The weather was charming, but, owing partly to the day of meeting being an inconvenient one for city men, and partly to the fact that many members of both Societies were away from home, the attendance was not so large as is usual on these occasions. The presence and assistance of two well-known naturalists had been hoped for, but professional engagements prevented their attendance at the last moment. About forty members of the two societies were present, including several ladies. The members of the Hertfordshire Club came by train from their county town to Waltham Abbey, and thence by coach to the "Wake Arms," the appointed rendezvous, under the conduct of one of the Secretaries, Lieut. Croft, R.N., F.L.S., arriving about one o'clock. Our own members reached the spot in detachments, some strolling over through the woods from the various forest villages, and others took train to Theydon Bois, and rode or walked up to the "Wake Arms." After pleasant greetings and a hasty luncheon, the united parties made for Monk's Woods, stopping occasionally to botanize, to examine and determine some doubtful insect, or to fish up in little bottles the microscopic inhabitants of the forest ponds and ditches. The late rain and the bright glint of the sunshine enhanced the fresh beauty of the beechwoods, and many were the expressions of pleasure and surprise from those who thus made their first acquaintance with the Forest. Although our looked-for experts were unable to attend, we were not without skilled assistance; indeed we had with us some very good observers, and the flora and fauna of the woods were fairly well investigated during our somewhat hurried peregrinations. The Hertfordshire contingent had with them their well-known botanical member, Mr. Bates Blow, while the Microzoa and Protophyta were registered by Mr. T. W. Phillips. With our Club were several amateur entomologists and botanists, and our visitor, Mr. James J. King (representing the Glasgow Natural History Society) was very busy among his own particular pets—the *Neuroptera*. In Monk's Woods the beautiful rose willow (*Epilobium angustifolium*) was gladly welcomed in full bloom as an old friend, and the abundance of the "stag's-horn" club-moss (*Lycopodium clavatum*) struck many of our visitors as a notable circumstance. In boggy places were seen that favourite of the biologist, the carnivorous *Drosera*, and the pretty *Anagallis tenella* (bog pimpernel); whilst in shady places the little bell-flower (*Campanula hederacea*) lifted its heart-shaped leaves and delicate blue corollas from its damp bed of *Sphagnum* moss. By one large pond, near High Beach, grew the two bullrushes (*Typha latifolia* and *angustifolia*), and in the pond itself were found several species of *Chara*, notably *Chara translucens*. Here Mr. Phillips

recorded the following low forms of vegetal life as the result of his dippings:—Algæ, *Pediastrum biradiatum* and species of *Spirogyra;* Desmids, *Closterium lunula* and others; Diatoms, *Meridion circulare* (abundant), *Synedra ulna*, *S. capitata*, *Navicula serians*, *N. crassinervia*, *Gomphonema stipitatum*, and *Fragillaria striatula*. In the woods the entomologists were much astonished at the extreme abundance of the yellow-underwing moth (*Triphæna pronuba*). Literally hundreds of these common but very handsome moths were disturbed as the party wandered through the woods, the insects taking a sharp flight of a few yards, flashing out a gleam of colour and then settling again, their dull mottled fore-wings concealing the gayer tints, and so rendering their detection amongst the greys and browns of the dead leaves and mosses a very difficult task.

The usual butterflies of the Forest were often noticed. By way of a sample, Mr. Lockyer netted a lovely fresh *Gonepteryx Rhamni*, *Satyrus Ægeria*, and a curious dark form of *Polyommatus phlæas*. Flitting about us were to be seen the "gatekeeper" (*Satyrus Tithonus*), common "blues," and in the sedgy open places in the woods the "common skipper" (*Hesperia linea*) was in great abundance.

Mr. King's take of Neuroptera was somewhat extensive, and the list is given entire, so little having been done in this direction in Epping Forest:—

Psocus longicornis, Fab. Very common, occurring on the oaks.
P. variegatus, Fab.
Stenopsocus immaculatus, Ste. Very common.
S. cruciatus, Linn. Common.
Cœcilius fuscopterus, Latr.
Peripsocus phœopterus, Ste. Not uncommon.
Elipsocus unipunctatus, Müll. Very common.
E. hyalinus, Ste. Very common.
Cleon dipterum, Linn.
Platetrum depressum, Linn. Common.
Æschna cyanea, Müll. Common.
Æ. grandis, Linn. Very common.
Pyrrhosoma minium, Harr. Very common.
Agrion cyathigerum, Charp. Very common.
Sisyra fuscata, Fab. Occurred near Loughton.
Hemerobius elegans, Ste., var. *Marshami*, Ste. Obtained by beating the bushes that skirted a pond near Loughton.
Hemerobius micans, Oliv. Very common all over the Forest. The var. *fuscinervis*, Schn., also occurred.
H. Humuli, Linn. Common.
Chrysopa alba, Linn. Constantly being beaten out of the bushes, &c.
C. aspersa, Wesm. Uncommon.
C. ventralis, Cur. Uncommon.
Coniopteryx Tineiformis, Cur.
C. aleyrodiformis, Ste.
Panorpa communis, Linn. Common.
P. Germanica, Linn. Common.
Grammotaulius atomarius, Müll. One specimen occurred at a ditch near High Beach.
Limnophilus affinis, Cur. Not uncommon.
L. centralis. Occurred everywhere.
L. sparsus. Very common.

Mr. Phillips was the only member of the party who diligently collected Microzoa, but he reported that the forest-ponds were very productive, especially near High Beach. His list of the contents of his bottles and tubes is as follows:—

Stentor niger.
Melicerta ringens.
Vaginicola crystallina.
Cothurnia imberbis.
Trachelius olor.
Arcella vulgaris.
Candona lucens.
Brachionus pala.
B. urceolaris.
Metopidia sp.? (no gizzard visible, possibly a male of *M. lepadella*).
Euplotes patella.
Coleps hirtus.
Actinophrys Sol.
Euglena viridis.
E. acus.
Phacus triqueta.
Pandorina morum.

High Beach having been visited, and the view over the valley of the Lea into Hertfordshire and Middlesex duly enjoyed, the whistle was vigorously sounded to gather together the dissociated elements of the party; and a delightful ramble through tangled brake and thicket brought the members to our ancient Camp, where Mr. Cole pointed out and explained the recent excavations and their results. After a thorough inspection of the site of the Camp, the return signal led the party back to the "Wake Arms," where a substantial "high tea" awaited us. Time did not permit of much talk. The Rev. W. Linton Wilson, M.A., took the chair, and in a genial speech cordially welcomed our Hertfordshire colleagues. Lieut. Croft, F.L.S., as Secretary of the Herts Club, expressed the pleasure of his members at their first incursion into Essex; many had that day seen Epping Forest for the first time, and he was sure they were both surprised and pleased. He hoped this pleasant *réunion* of the two societies, so closely united in purpose and constitution, would become an annual affair. The presence of ladies at the meetings was a feature cordially welcomed by both clubs, and he was sure all had reaped the benefit of the regulation in the graceful assistance rendered by their lady members at the tea-tables. Soon after tea the Hertfordshire detachment mounted their coach *en route* for Waltham, and the members of the Essex Club wandered through the woodlands to Loughton and Theydon Bois in the cool calm evening of a perfect summer day.

MONDAY, AUGUST 1ST, 1881.—FROM EPPING TO THEYDON GARNON, ESSEX.

[*In the circular announcing the previous Field Meeting it was intimated that "On Bank Holiday some members will meet at Epping Station on the arrival of the 10.13 train from Fenchurch Street, for a country ramble. Those intending to join should communicate with the Secretary." The Secretary and Librarian were duly in attendance, but only three other members put in an appearance. However, this triad included the botanical skill and local knowledge of Prof. Boulger and Mr. English, and a very pleasant and profitable day was spent. The following sketch of the ramble is from Prof. Boulger's notes, supplemented by a few observations by Mr. English and the Secretary.*—ED.]

As our small but enthusiastic party left the Epping Station, the first object of botanical interest to attract our notice was the rest-harrow, of

which the spiny variety (*Ononis campestris*) only prevails thereabouts. The common elm at this locality is a remarkably small-leaved form, the leaves on young and vigorous shoots being diminutive; and during the whole day *Quercus pedunculata* was the only form of oak we met with. Plunging into the luxuriant vegetation of a rough sloping bank of waste-land by a green lane we speedily came upon much of interest; quantities of flea-bane (*Pulicaria dysenterica*), meadow-sweet (*Spiræa Ulmaria*) with its characteristic gall, the result of the "house holdings" of a small gall-gnat called *Cecidomyia Ulmariæ*, an oak stump with its twigs much affected with both the Devonshire or marble gall (the work of *Cynips Kollari*) and the very curious artichoke gall (*Aphilothrix gemmæ*, L., *C. fecundatrix*, Hart.), the result of the distortion of the leaf or flower-bud of the oak by the insect. Other plants noticed were some fine examples of thistles (*Onopordon Acanthium* and *Carduus palustris*), red campion (*Lychnis diurna*), tufted vetch (*Vicia cracca*), willow herbs, and St. John's worts. The handsome teasels (*Dipsacus sylvestris*) with several pairs of connate leaves, forming pitchers crammed with animal matter, suggested some remarks on accidental and purposive structures; whilst as they were just in flower, they also illustrated the artificial nature of the classification of inflorescences into centrifugal (in which the central flower opens first) and centripetal (in which the order of development is the reverse, the lower flowers opening first); in the teasel tribe (*Dipsacaceæ*) many examples occur, as in *D. sylvestris*, of a combination of both forms of development. *Convolvulus sepium*, generally preferring cultivated ground, was, however, plentiful, as also was the bittersweet (*Solanum Dulcamara*); whilst in fruit were noted the pepper wort (*Lepidium campestre*), cuckoo-pint (*Arum maculatum*), black bryony (*Tamus communis*), and cleavers (*Galium Aparine*), the abundance of which last afforded a practical exemplification of one mode of seed-dispersal, the curious little rough fruit with its hooked bristles clinging in hundreds to our clothes as we forced our way through the thick herbage. The large compound umbels, hollow or "fistular" stems, and pinnately-divided leaves with large basal sheaths, of fine specimens of *Angelica sylvestris* (suggesting to our entomologists *larvæ* of *Eupitheciæ*) and the cow-parsnip (*Heracleum Sphondylium*) illustrated the order *Umbelliferæ*. We leave the "siding" to pass through Steward's Green, as it is called,—a long green lane, which seems to possess some interest to the entomologist and botanist. Here we encountered the centaury (*Erythræa centaurium*), *Hypericum hirsutum*, and a remarkably small-flowered *Epilobium parviflorum*, which were "bagged" previous to the "interval for refreshment." The bittersweet was luxuriating in a pond by which stood some sycamores, free from the fungus *Phytisma*, and covered with their winged "samaras." The "Theydon Oak," growing by a pond not far from the Inn, is now a mere wreck, and was estimated at twenty-six feet girth and to be *not less* than three centuries in age. The party then plunged into Theydon Garnon or Coopersale Forest, dense with holly and hornbeam, and apparently

part of the ancient Forest of Essex. Hard by was a meadow locality for adder's-tongue (*Ophioglossum*) and *Orchis Morio*, known well to Mr. English, round the borders of which some splendid plants of *Equisetum* were growing. Returning to the Forest, we crossed a bog where the white-rot (*Hydrocotyle vulgare*) abundantly illustrated a departure from the normal foliage of umbelliferous plants, and here a few species of *Fungi* were noted. *Russula vesca*, with its rosy pileus; *Marasmius urens*, a poisonous species with a very pungent odour; *Agaricus fuscipes* and *A. appendiculatus*—common, but welcome when other forms are not to be found. Here also we met with *Stereum purpureum*, an unusual sight at this season of year; usually the plant is only found in perfection during the winter time. Passing onward through a rushy swamp, which in spring is always gay with flowers, notably *Caltha palustris*, we cross the new road to Gayne's Park and enter the fields known as the "Lawns," where in days gone by Mr. English tells us the *larvæ* of the burnet moth (*Zygæna filipendula*) used to swarm, and where at early morn the vagrant cuckoos could be seen feasting on the unsuspecting caterpillars. From the "Lawns" we enter the fine woods, which, although contiguous, are known by the several names of Gaynes Park Woods or "Birchen Copse," Hawk's Hill and Ongar Park Woods. Having previously noted *Bartsia eu-Odontites* and the yellow rattle (*Rhinanthus crista-galli*), we now come upon a third of the semi-parasitic Scrophulariads, the cow-wheat (*Melampyrum pratense*); and in a ditch, then dry, near the site of the "Centre-tree" (now a thing of the past, but the seven rides or "wonts" converging still mark the spot), was abundance of the skull-cap (*Scutellaris galericulata*), with the wood pimpernel and the money-wort (*Lysimachia nemorum* and *Nummularia*). Here Mr. English, from a well-remembered spot, obtained abundance of the rose-bay (*Epilobium angustifolium*), *E. hirsutum*, *E. palustre*, and *E. obscurum* being also noted during the day; whilst their graceful ally, the enchanter's night-shade (*Circæa lutetiana*) was abundant. On the trunks of the oaks we noticed many specimens of the fine moth, the "black arches" (*Liparis monacha*), and one or two of *Epunda viminalis;* whilst among the butterflies the fresh *Gonepteryx Rhamni*, some *Vanessidæ*, "gate-keepers," "blues," and "skippers" were welcomed as very old friends. The alders yielded many specimens of a remarkable stalked gall on the upper side of the leaves, the work of one of the *Phytopi* or gall-mites (perhaps *Cephaloneum pustulatum*, Bremi.); and on the maples were thousands of the reddish leaf-galls of another mite (*Cephaloneum myriadeum*), and the wild roses bore "bedeguars" in abundance. Taking the Epping ride, one of the seven, we descended the hill, noting the fungus *Lactarius piperatus* on the banks, regained the Coopersale Forest, and then made for the gravel-pits. Here *Hottonia palustris*, we were told, had once been common, but had apparently been exterminated by the gravel-digging. But we found a nice *Sphagnum* bog, containing abundance of a plant somewhat rare in South Essex,—*Menyanthes trifoliata*,—the eathery

petals of which will afford a problem in another season for the local Darwinians. Round about was abundance of the historic needle-whin (*Genista Anglica*), and this spot afforded an agreeable finish to the day's botanizing. Among the other plants noticed during the day were, *Achillea ptarmica*, *Hypericum perforatum*, *humifusum*, and *pulchrum*, *Epilobium hirsutum* and *obscurum*, *Geranium dissectum*, the two pretty legume bearers, *Lotus major* and *corniculatus;* and our note-books contained entries of more than one hundred plants. After witnessing the "polo" play on Epping Plain, and examining Mr. English's old-fashioned garden of hardy plants, his preserved *Fungi* and other specimens, we betook ourselves to the station, which we left in a heavy fall of rain and—a somewhat crowded condition.

Saturday, August 13th, 1881.—Field Meeting and Ordinary Meeting.

A Visit to Chelmsford and Danbury.*

It afforded the Council great pleasure to hold a Field Meeting in conjunction with the subscribers to the "Essex and Chelmsford Museum," as tending to promote those feelings of good-fellowship and mutual encouragement which should prevail between societies having objects so much in common—the diffusion of a taste for the study of Science and increasing the opportunities for intellectual recreation in the county. Mr. Edmund Durrant, Hon. Secretary to the "Museum," took great interest in the affair, and to his kind exertions much of the success of the meeting was due.

The weather was not so genial as could be wished. On the Friday preceding the meeting the rain came down heavily all day, and made the prospect of Saturday anything but cheering. Saturday itself opened dull and threatening, and later on it fulfilled its threat by an occasional shower, which, however, did very little to disturb the day's enjoyment. Still it was a chilly day, and the lowering skies did not show the country at its best. The untoward weather had the effect of keeping at home a great many members of the Essex Field Club who would otherwise have gone to Chelmsford, but, nevertheless, a fair number assembled at Liverpool Street Station in the morning, and went down to the county-town by the 10 a.m. express train. The Club was for the first time enabled to take advantage of the concession of the Directors of the Great Eastern Railway Company, by which *members* are allowed to purchase a return-ticket at a single fare from the Liverpool Street, Buckhurst Hill, Woodford, or Stratford Stations, to any given station on the railway in

* The Proprietors of the 'Essex Times,' the 'Essex Weekly News,' the 'Chelmsford Chronicle,' and the 'Essex Herald' sent representatives to this Meeting, and the several newspapers for the week ending August 20th contained lengthy and excellent reports of the same. The two first-mentioned papers printed Mr. Chancellor's memoir *in extenso*. —Ed.

the neighbourhood of which the Club might from time to time hold either Field or Ordinary Meetings.

On reaching Chelmsford a move was quickly made to the "Saracen's Head Hotel," in the High Street, the appointed head-quarters for the day. After a short stay there, and not a few pleasant introductions and hand-shakings, the company—now considerably augmented by fresh local arrivals—proceeded across the road to St. Mary's Church, Mr. F. Chancellor (Architect to the Diocese),—who, thanks to a long and loving study of its architectural and antiquarian details, is perhaps better qualified for the task than any other man in Essex,—having kindly undertaken to act as their "guide, philosopher, and friend," in connection with the inspection of that ancient and stately edifice. Taking his stand under one of the noble arches of the tower, Mr. Chancellor read an elaborate paper upon the Church, giving its history from 1424 up to the present time, and lucidly explaining its architectural features and its points of historical and antiquarian interest. We much regret that the limits of these reports, and the scheme of the Club as mainly a Natural History Society, precludes the insertion of this valuable paper in its entirety. Mr. Chancellor began by referring to the very meagre records of the ancient history of Chelmsford. There could be no doubt that a Church existed there from very early times, and it might fairly be presumed that the structure was one of some importance; but, except what might have been used in the shape of old materials in the building of the walls of the present edifice, no remains of it are extant. Doubtless the old Church, which partook probably of the Norman character, was utterly annihilated by the townsfolk when they determined upon re-building of their parish Church in 1424. That John De Vere, twelfth Earl of Oxford, whose family was possessed of the "Old Black Boy," and who probably made Chelmsford a halting-place and an occasional residence in his journeys to and from Hedingham Castle to London, aided in the work of rebuilding the Church, was proved by the fact of his shield, charged with the mullet, being carved in the spandril of the west door of the tower, and by his crest, the boar, being introduced in the apex of the arch of the same door. This latter corresponded with the carved boar which formed part of the ceiling of an apartment in the "Old Black Boy." The Bouchiers, the Mountneys of Mountnessing, the Beauchamps, the Nevilles, the Mowbrays, and the Warners of Great Waltham, all undoubtedly contributed to the re-edification of the building, for their arms decorated the roof, and were emblazoned in the east window. Although all that remained of the old structure was the tower, the south porch, and a few other fragments in the aisles and chancel, they were sufficient to prove the care taken in its building. The tower was one of the strongest and most enduring pieces of workmanship in the district. It had withstood the storms of four centuries with scarcely an impression made upon its massive walls, and, unless damaged accidentally or wantonly, it would last for as many centuries more. In 1424 the Perpendicular style had

established itself throughout the country, and the new edifice was erected wholly in that style; and although some of the details were poor and somewhat debased, there was still an air of magnificence about the old tower which was sufficient of itself to stamp its architect as a master of his art.

Mr. Chancellor gave a minute description of the tower as it was left by its architect in 1424, but in 1749 misfortune came; the sapient townsmen thought that the effect of the whole building would be increased by a spire, and that wretched apology for one which still crowned and disfigured the tower was erected.

After speaking of the bells and reproducing the quaint poetical inscriptions upon them, Mr. Chancellor said that, next to the tower, the south porch demanded attention. Consisting of two stories, it was a more imposing feature than usual; the room over it had for many years been utilized as a depository for wills, and probably had always been used for the transaction of ecclesiastical business. It now contained the library left by the late Dr. Knightsbridge. The external appearance of the porch was at present destroyed by the "abominably hideous projection containing the staircase." A highly-enriched niche, which probably contained a sculptural representation of the crucifixion, surmounted the archway. The body of the Church, consisting of the nave and aisles, was almost totally destroyed in 1800, when the roof fell in, and but a few fragments remained of the original work. The plan of this part of the structure was the same as at present, except the recent additions of the north aisle and transept, as the new walls were erected upon the old foundations, such parts of the old structure as were sound being worked into the new edifice. The arches were doubtless the same as at present, but they carried a clerestory of a very imposing character. The west end of the north aisle was the most important fragment left of this portion of the building of 1424. Fortunately the roof remained and served as a key to that of the nave. The noble effect of even these few fragments compelled them to pause and endeavour to realise the grandeur of the old structure in its original glory, with its massive oaken roof spanning both the nave and aisles, enriched undoubtedly with shields and banners in all the tintings of heraldry, and possibly with its mouldings revelling in a sea of gold and red and blue. A noble clerestory enriched with painted glass lighted up the whole building, bringing out by the reflected lights the depths and shadows of the old oak framing, the lofty arches of the tower forming a fitting entrance to the goodly structure, and the long vista terminating in the richly-painted window of the chancel.

On the 17th of January, 1800, the whole of the roof fell with a tremendous crash, carrying with it the greater part of the nave-walls, and rendering necessary a re-edification of nearly the whole of the structure. For this purpose it appears an Act of Parliament was required. The inhabitants, as in 1424, set to work in good earnest—would that their zeal had been better rewarded; but unfortunately at that time Gothic

architecture was not appreciated, its beauties were ignored by those who ought to have upheld them, and he could not endorse the opinion of a recent historian who said that the present Church was "a monument of liberality and taste." The liberality of the inhabitants was undoubted, and was well worthy of emulation, but the taste in which the work was executed was most questionable.

For three hundred years,—extending from the commencement of the 16th to the commencement of the 19th century,—although surrounded by the most exquisite examples, our ancestors appeared to have been insensible to the charms of Gothic architecture, and to have ridiculed it in every conceivable manner; brighter days had dawned upon them, and Gothic architecture, like a Phœnix, had risen from her ashes and was re-asserting her power over the length and breadth of the land.

The monuments in a Parish Church frequently form the chief materials for the history of the place; and in the small and unpretending Village Church, where the surrounding lands have passed from father to son for generations, we find the most magnificent specimens of these memorials; but in a town, where exchange of property is more frequent and where the family monuments are left without natural protectors, they are destroyed or mutilated without remorse. Considering the wealth and power of the neighbouring lords, there could be no doubt that formerly many memorials existed of those who once held sway over the district, but they were all gone, and three brassless stones alone remained as representatives of the early monumental history of the fabric. The oldest monument was that to Thomas Mildmay, of the date of 1571, which bears a very quaint Latin inscription. Upon one of the walls of the north chancel aisle was an interesting inscription on a brass tablet, compiled, he believed, by the late Archdeacon Mildmay, which set forth the names of those members of the Mildmay family who lay buried either in the old Mildmay vault or in the precincts of the Church, together with the dates of the burials. Mr. Chancellor referred to the improvements which had been effected since 1867 in the removal of the galleries; the addition of a second north aisle and the north transept; the remodelling of the chancel by the construction of a new east window; the addition of a clerestory and new roof; and concluded by saying that the party had travelled round, over, and he might almost say under the Church, and he believed that he had directed attention to every part of it to which any interest was attached. Hidden from view in the walls of the Church itself, or on the bookshelves of great public libraries, much information might still exist, and if any person would undertake the task of thoroughly searching old records and volumes, many curious facts might be discovered, and much light thrown upon the character of the original structure, at the existence of which he had only been able to glance.

The paper was listened to with great interest and attention throughout, and after a thorough inspection of the Church—not forgetting the remains of the Knightsbridge library, now fast hastening to decay by reason of

neglect, vermin and damp—the company walked to the Museum in Bridge Street, under the guidance of the Rev. R. E. Bartlett, M.A., the Honorary Curator, and Mr. Edmund Durrant, the Honorary Secretary. The Museum contains some interesting objects, notably a general collection of shells and specimens of Roman and other pottery found in Essex. But the paucity of local specimens, and the absence of proper labels, detract very much from the value of the contents of the Museum. Mr. Bartlett gave a brief but interesting sketch of the history of the institution, and did all in his power to render the visit a pleasurable one.

Many of the Members of the Club were most hospitably entertained at luncheon by Messrs. Durrant, Chancellor, Baker, and other townsfolk. About half-past one o'clock there was again a gathering at the "Saracen's Head," from whence the party was carried in drags and other conveyances through pleasant lanes and by smiling corn-fields, past Great Baddow and Sandon, over Wood-hill, and so to the Bishop's Park. As we rode through Great Baddow, attention was called to the fine "Copper Beeches" (*Fagus sylvatica* var. *purpurea*), in one of the park-like gardens. Tall plants of *Typha angustifolia* were espied in a pond by the roadside, and the spectacle of large patches of the handsome *Lythrum Salicaria* gave rise to a discussion on the tri-morphism in the structure of the flower of that plant, which was so thoroughly investigated by Darwin. Mr. John Gibbs (a well-known Chelmsford botanist) remarked that he was sure he had found all the three forms in his own neighbourhood.*

At Sandon a short halt was made to give an opportunity for the inspection of the quaint little Church of St. Andrew, which is believed to be of great antiquity. Here were some gigantic elms by the Church gate—a row of massive and venerable trees that have skirted "God's-acre" for centuries. One fine pollarded specimen (*Ulmus campestris*, With., var. *vulgatissima*, Miller) was measured by Professor Boulger, and found to

* On September 3rd, Mr. Gibbs wrote:—"On Monday last I took a walk in search of *Lythrum Salicaria*, and in a ditch bordering a lane between Chelmsford and Writtle, I gathered 33 twigs from different plants. On examining them, I found 12 long-styled, 16 mid-styled, and 5 short-styled, so that I was not after all in error when I said that all three forms are to be found near Chelmsford."

Mr. Gibbs has also handed to the Editor a list of native flowering plants, observed by himself in the neighbourhood of Chelmsford, 374 in number, which will best form the subject of a separate communication. He remarks that "the list does not include several plants, natives of other parts of England, and in cultivation here, as lucerne (*Medicago sativa*). *Tragopogon porrifolius* is only found on the banks of railways, to which places the winged monospermous fruits are believed to have been conveyed by wind. Several species included in my list may have been destroyed by the removal of woods, of which many acres have been cleared since I observed *Epilobium angustifolium* and *Paris quadrifolia* growing in them. There are, however, many plants not included, especially Cyperacea, and probably several species of *Potamogeton*. *Œnanthe Phellandrium* has been very luxuriant this year in ponds and ditches near Chelmsford, and being a very poisonous Umbellifer it may possibly cause the death of cattle, who are not botanists enough to distinguish it from the Water Parsnep, when taken from ponds and left upon the land by men who are not better botanists than the cattle."—Ed.

have a circumference of more than 20 feet. In the fissures of the brick-work of the Church, the pretty ivy-leaved toadflax (*Linaria Cymbalaria*) grew freely. Springing from the tower above us was a tree (which the villagers declare to be an elder), probably the result of the growth of a seed conveyed thither by a bird.

The chief features of interest in the Church were pointed out by Mr. Chancellor. It contains a remarkably perfect pulpit, dating from the time of Henry the Eighth. In design and execution it is like a very fine example of perpendicular work, and of it Mr. Chancellor remarked that he did not know of another in Essex which was so perfect, so complete, and in design so beautiful. The chancel arch came in for a great deal of notice. It is evident that a narrower chancel arch at one time existed,—probably Norman,—and it is well known that the Norman chancel arches in Essex churches were often very narrow. The present arch has been formed by cutting away the narrower arch and so enlarging it. Over the centre, facing the altar, is a curious arched recess, the purpose of which was not explained, though it looks as if it had been intended to hold an image. A few words were also devoted to the small pieces of coloured glass inserted in the east window, which Mr. Chancellor deemed to be probably original, and attention was called to the centre shield, bearing the device of the St. Clere family, monuments of whom are in Danbury Church. Greater interest still was shown when the speaker directed attention to what is known as a "leper window," or "low side window," as to the purpose of which archæologists are divided. One theory is that these windows were contrived to allow of the administration of the Sacrament to the lepers, who were not allowed inside the church. Another is that they were intended to permit the sacristan to hold the bell outside and ring it at the consecration of the elements, to convey to the village information of the performance of the rite. The point was freely discussed at a late meeting of the Essex Archæological Society, and is yet far from settled. Mr. Chancellor described the tower of the church as a very fine specimen of the many brick towers constructed in this county in the time of Henry the Seventh and Henry the Eighth. And he added, in words that would make the builders of to-day blush, if a man with the power to blush could be a nineteenth-century builder, that the brickwork was extremely good, "as all the brickwork of *that* time was." Attention was also called to some curious mural brasses, one of them with the date obliterated, bearing a quaint inscription to the memory of "Patrick Hearn Clark, late parson of this parish of Sandon."

Leaving Sandon, the party followed the road which winds up the Danbury heights, through charming country, the prospect of which widened as the elevation increased, giving fine glimpses of sylvan scenery. Mr. Gibbs pointed out a bank by the roadside, on the rising ground quitting Sandon, as a station for *Claytonia perfoliata*, Don, a North American plant, sometimes found in a semi-wild state. Mr. Gibbs states, "It was in May, 1858, that my friend, the late Mr. Edward

Copland told me that his son, who was then ill and soon afterwards died, had found such a plant in the previous August. I therefore went in search of it and found it in the place where it has grown ever since. As Mr. Copland flattered himself that he had made an addition by his discovery to our list of native plants, I never told him what I afterwards learned from the cottager who occupied the garden bounded by the hedge under which this interesting plant grows :—that the Bishop's gardener had given him some seeds of American annuals which he sowed, and that the *Claytonia* in particular had overrun the ground and finally established itself by the wayside."

Arriving at the Bishop's Park at Wood-hill, the "traps" were dismissed with instructions to the drivers to "wait at the 'Griffin'" until the afternoon's ramble was over. With great courtesy the Bishop of St. Alban's had readily accorded permission to the members to stroll through a portion of the park, at the same time expressing his regret that the fact of his daughter's marriage with the Duke of Argyll taking place on that day would prevent him from having the pleasure of offering them the hospitality of the Palace. The saunter through the grandly timbered park with its picturesque clumps of oak, beech, and elm, its glades and avenues and charming pieces of ornamental water, was thoroughly enjoyed by all. In the ponds were noticed the white water-lily (*Nymphæa alba*), *Myosotis palustris*, *Mentha hirsuta*, the graceful *Alisma Plantago*, and the deliciously fragrant sweet-flag (*Acorus Calamus*). Mr. Jaggs, the park-keeper, called attention to a fine oak tree (*Q. pedunculata*), with leaves curiously variegated, but bearing acorns invariably producing normal plants. Professor Boulger (who acted throughout the afternoon as "botanical conductor," and of whom it was good-humouredly asserted by one of the party that, in the language of the motto to 'Notes and Queries,' he proved himself the most "learned, chatty, and useful" of guides) was disposed to attribute the variation to the presence of a parasitic Alga in the cells of the leaves. The variation is contagious but not hereditary in some ivies, and regret was expressed that the tree did not stand in the midst of a grove of oaks, in order that it might be seen whether the disease would be communicated to them. Near this was a small slip of willow brought by Mrs. Campbell from the tomb of Napoleon I., at St. Helena, and now growing healthily and vigorously in the Essex park. In the walk through the woods several other interesting plants were noticed, particularly *Ruscus aculeatus*, the only British monocotyledon with a woody stem ; this also grows on Danbury Common and at Little Baddow, so plentifully as to leave no doubt as to its being a true native. Piloted by Mr. T. M. Gepp, who appeared to be familiar with every inch of the ground, the party made its way through the woods, halting to be let through a gate here, and having to clamber over a fence there, from the park to

"The decent Church that tops the neighbouring hill,"

which is built within the bounds of the ancient camp. This is one of the

highest points in Essex, and from it a magnificent view was obtained in all directions over the surrounding country. Several of the gentlemen of the party ascended the tower, the scene from which amply repaid the awkwardness of a part of the climb—that through the belfry, to wit, which might well dismay unpractised climbers. The air was not too clear, and the mist hid some of the more distant points, only lifting a little to allow of a perplexing uncertain glimpse, and then closing and blotting all out. But though bright sunshine would doubtless have made the prospect much grander, it was yet a very fine one. In the distance was the town of Maldon, and southwards lines of light showed the course of the river Crouch and the mouth of the Thames, and those visitors whose acquaintance with Essex and its many scenic beauties was limited, were charmed with the outlook and were even ready to admit how little the county deserves the commonly bestowed stigma of tameness.

In the building itself Mr. Chancellor's descriptive powers and architectural lore were again called into requisition to amuse and instruct the visitors. Danbury Church, dedicated to St. John the Baptist, contains, as was pointed out to the visitors, memorials of the days of the Crusaders not to be exceeded, it is said, by any others of the kind in the kingdom, not even by those in the Temple Church. The carved benches and stalls in the chancel, and the beautiful stone altar screen, are the work of the modern artificer on the occasion of the restoration of the Church some years ago ; but the piscina and part of the sedilia speak of ancient days, and portions of the building are of very old date. The building has been twice injured by lightning, once in 1402, concerning which Hollingshed states in his 'Devil of Danbury'—"Vpon *Corpus Christi* day, in the yeare 1402, the third of Henry the Fourth, at evensong time, the Devill entred into this Church, in the likeness of a Gray frier, and raged horribly, playing his parts like a Devill indeed, to the great astonishement and fear of the parishioners ; and the same houre with a tempest of whirlewind and thunder, the top of the steeple was broken downe, and halfe of the chancel scattered abroad." And again, on 5th February, 1749-50, lightning struck fire to the spire and about 20 feet of it was burnt. Under low arches in the walls of the aisles are three recumbent figures of cross-legged knights carved in wood, which are undoubtedly effigies of three crusaders of the St. Clere family, the former lords of the parish. The feet of each figure are supported by a lion, and every lion and every man is in a different position—a fact which is considered by certain learned antiquarians to be emblematic of the manner of their deaths. The crossed legs of the effigies go to show that the warriors whom they represent were crusaders of the days of Richard or Edward I. The body of one of these crusaders was discovered about 100 years ago by some workmen who were digging a grave. It was encased in a leaden shell with two outer coffins, and was found to be in a good state of preservation, this being due to the influence of a liquor in which it was lying.

Leaving the Church, an inspection was made of the ancient camp,

under the direction of Mr. E. Corder. Nothing definite can be gleaned from the pages of local historians as to the date or intention of this earthwork. There is a rude plan of the camp in Morant's 'History of Essex,' but very few details are given, and even local tradition is almost silent, a vague notion that it is a military fortification of some kind only obtaining in the district, and apparently some people admit feeling a certain amount of scepticism as to its being a camp at all! But there can be little doubt upon that point—in more than one place the form of the rampart is abundantly evident, and the glacis well-defined. In the absence of careful surveys and measurements, and a scientific exploration of the ramparts themselves, it would not be wise to hazard any statement with respect to the probable date of the work. It is evidently well worthy of study, and it is very desirable that some effort should be made to clear up the doubts which attach to it.

Time did not admit of any extended "prospecting" in the neighbourhood by the naturalists of the party. Danbury seems to be as well fitted as any place in Essex for the researches of the biologist. Mr. Corder stated that the park is a good place for birds, and that they are not disturbed. The old trees harbour Brown and Barn Owls, Green Woodpeckers and Nuthatches. Hawfinches build in the park and other wooded parts of Danbury Hill. Mr. W. D. Cansdale, then residing at Witham, who was of the party, stated that "although from an entomological point of view Danbury might not be entitled to rank on an equality with other insect hunting-grounds in the county, yet the large number of species that have been taken there from time to time sufficiently indicate that if well-worked the district would prove to be a very productive one. The parish is well studded with woodland, with several commons, in and through which the entomologist can thread his way with tolerable ease. The underwood consists principally of oak, hornbeam and birch, with a fair supply of sallow. The wild *Clematis* is plentiful, a certain guarantee that many species may be found which are seldom met with in districts where that plant does not occur."

The visitors noticed the pretty cornfield alien, *Geranium pyrenaicum*, in the hedgerows, and *Verbena officinalis* (the favourite plant of the Druids), found bordering the pathway near Danbury Church, was jokingly put forward as an evidence of the British origin of the camp. *Bryonia dioica* in fruit was a conspicuous object in the hedges. Professor Boulger, who has made a special study of our native elms, pointed out *Ulmus montana*, Smith, var. *nitida*, Syme, on the second line of "ramparts." Mr. Corder alluded to some interesting plants known as occurring in the neighbourhood. On the commons he said were to be found *Drosera rotundifolia* and the bog pimpernel (*Anagallis tenella*), and that in a certain spot grew a few plants of the pretty maiden pink (*Dianthus deltoides*) which appears not to be found wild elsewhere in Essex.* On Woodham Walter Common ferns

* Gibson in the 'Flora,' gives only one station—"on a wall at Witham, probably an escape. This is truly wild at Hildersham (Cambridge), beyond the borders of this county, but has not yet been so found in Essex."—Ed.

are numerous. *Osmunda* was once abundant but is now probably extinct. *Nephrodium* (*Lastrea*) *Thelypteris*, *Convallaria majalis*, *Erica Tetralix*, and alders and buckthorns also grow there.

Halting at a field gate on the way back to the "Griffin," Professor Boulger read a paper "On the Origin and Distribution of the British Flora" [Transactions, ii. 69]. A very cordial and unanimous response was made to the request of the President, seconded by Mr. H. Walker, that thanks should be voted to the author for his admirable essay.

Much regret was felt that time would not admit of a visit to Sir Brook Bridges' woods, permission and facilities to visit which were kindly given by Mr. T. M. Gepp.

Upon returning to Chelmsford at about six o'clock, the company sat down at the "Saracen's Head," to one of the "high teas" now so well known to members, admirably served by Mr. Fuller.

At the close of the repast Mr. Meldola proposed, in a few well-chosen words, votes of thanks to those who, by their kind aid, had so much enhanced the success of the meeting:—to the Bishop of St. Albans, the Rev. R. E. Bartlet, Mr. E. Durrant, Mr. Chancellor, Rev. T. P. Bridges, Rev. S. T. Gibson, Mr. Gepp, Professor Boulger, Mr. H. Corder, and others who had in various ways given valuable assistance. He was very glad on the present occasion to see that they had among them so large a number of their colleagues of the "Chelmsford Museum," and he hoped that this mutual arrangement might hold good for many future meetings. At the same time they must not forget to return their most cordial thanks to those members of the Museum who had been good enough to receive and entertain them in the very kind and hospitable manner they had done that day. [Applause].

Mr. John Spiller, F.C.S., said, as that was the first occasion on which the members of the Essex Field Club had been able to come and go by rail on easier terms than usual, he should like to include among those to whom votes of thanks were given the Directors of the Great Eastern Railway Company. [Hear, hear.] As a Londoner he was glad to find that the Great Eastern Railway Company had, so to speak, recognised the Society, and that its members would, in future, be able to travel by rail to their various meetings on more advantageous terms than persons who were not interested in scientific pursuits. About three weeks ago a Deputation, of whom he was one, waited on the Directors, and were most kindly received by Mr. Parkes, the Chairman, and when he had heard what they had to urge on behalf of this, their local scientific Society, he, on behalf of the Directors was good enough to accord them the privilege they asked for. He thought, therefore, that when they were passing these votes of thanks they should include in them thanks to the Chairman and Directors of the Great Eastern Railway for the concession they had granted them. [Hear, hear.]

The votes of thanks having been carried by acclamation, Mr. Durrant briefly responded on behalf of the Museum, assuring the members of the

Field Club that it had been a very great pleasure to the members of the Museum to welcome them in that town. [Applause.]

Mr. Chancellor said he was exceedingly obliged to them for the kind vote of thanks they had passed to him. All he could say was that it had been to him a labour of love, and it had been a great pleasure to him to meet the gentlemen belonging to a Club which was considered, perhaps, to trench somewhat on the manor of the Essex Archæological Society. He had been on the Council of the Archæological Society since it started, and he could only say he was very pleased to welcome fresh labourers. Essex had been somewhat barren of archæologists. He did not care whether they came from inside or outside their Archæological Society, and he was pleased at all times to forward their views, and to explain, as far as his information would allow him, anything that came in his way. [Applause.]

The meeting then resolved itself into the Eighteenth Ordinary Meeting of the Club, the President taking the Chair.

The following were elected members :—W. Wakeling Boreham, J.P., F.R.A.S., Edward Brown, Rev. L. Cockerell, M.A., Edmund Durrant, (Hon. Sec. Essex and Chelmsford Museum), Frank L. Emanuel, F. H. Forward, G. W. Gould, G. T. Jones, M.D., &c., G. Alan Lowndes, J.P., D.L., &c., D. H. Neale, Henry Spicer, B.A., F.L.S., F.G.S., Mrs. S. Warburg.

The President read the "Report on the Excavation of the Earthwork known as Ambresbury Banks, Epping Forest," which had been drawn up by General Pitt-Rivers, F.R.S. [Transactions, ii. 55.]

The plans and sections of the camp (enlarged for the occasion by Mr. H. A. Cole), and photographs of the works by Mr. J. Spiller were exhibited, as was also the coloured plate of some of the objects found, which the author proposed to publish in the 'Transactions' at his own expense.

The Rev. W. Linton Wilson, as a member of the Committee of Exploration, proposed that a very hearty vote of thanks should be passed to General Pitt-Rivers for the excellent report he had prepared and for his liberal donation of the coloured plate to illustrate the same. The plate would cost about £12, and was therefore a very handsome present to the Club.

Mr. Henry Walker warmly seconded the proposal. They had very successfully arrived at the conclusion that the Camp was British,—either ante-Roman or post-Roman,—but after all it occurred to him they had not invalidated the tradition that the work was associated with the British Queen Bodug, whom all had read of under the Latinised name of Boadicea.

The vote of thanks was passed by acclamation.

The President hoped that the Club would not allow the work so well begun to drop. The county of Essex appeared to be particularly rich in these early earthworks. He considered that they could investigate these without in any way trenching upon the province of their colleagues the Essex Archæological Society, inasmuch as in them they were

mainly dealing with pre-historic periods. He hoped that at least next year they might be enabled to commence a similar excavation at the Loughton Camp, and a subscription would be started for that purpose at once. The camp they had visited that afternoon on Danbury Hill should also be well kept in mind—no one appeared to know anything about it, and he was afraid many local gentlemen were somewhat sceptical as to the existence of a camp there at all. That also should be a matter for future investigation, and he confessed that he would very much like to see the Club with its shovels and picks at work on those ramparts. [Laughter and applause.]

Mr. Chancellor said that the late Lord Braybrooke, who took great interest in earthworks, visited the mounds at Woodham. He (Mr. Chancellor) spent the whole day with him there, and his Lordship came to the conclusion that these mounds were erected merely for the protection of cattle in flood time. He hoped the Club might be enabled to investigate one of these mounds. At Ashington, where a great battle was fought, there was a mound and evident traces of earthworks of some age. Mr. Chancellor also referred to the Roman camp at Bradwell, which was investigated by the Archæological Society, and which was proved to have been a walled camp, with circular towers at the angles.

The President asked if any excavation had been made at Danbury.

Mr. Corder said that he had lately heard of some so-called Roman remains having been found there.

Prof. Boulger remarked, that in almost every place he had visited, the name of which ended in "bury," he had recognised earthworks.

Mr. Fitch mentioned the Barrow Hills, between Heybridge and Goldhanger. It was there that the great battle of Maldon was fought, the bloodiest battle before the Conquest. Some thirty or forty years ago they were diminished and a number of bones were then found.

Mr. Chancellor, at the close of the meeting, proposed a vote of thanks to Mr. Meldola, which was seconded by the Rev. C. B. Hamilton, and carried unanimously.

During the meeting Mr. Fitch exhibited a fine living larva of the Death's Head Moth (*Acherontia atropos*) found near Maldon feeding upon the Bitter-sweet (*Solanum dulcamara*).

Saturday, September 24th, 1881.—Ordinary Meeting.

The Nineteenth Ordinary Meeting of the Club was held at the Headquarters, Buckhurst Hill, at seven o'clock, the President in the chair.

Donations of books, pamphlets or periodicals (exclusive of exchanges) were announced from Messrs. H. J. Barnes, Walter Crouch, H. G. Fordham, A. Lockyer, R. Meldola, and Miss E. A. Ormerod. A unanimous vote of thanks to the donors was passed.

The following were elected members of the Club:—James W. Cook,

Bernard T. Halford, B.Sc., Charles J. Leaf, F.L.S., F.G.S., F.R.M.S., F. H. Meggy, Mrs. Marshall, F. G. Newman, Frederick Oliphant, George Rees, Simeon Warburg, and Compton Warner.

Mr. Lockyer announced that Mr. Fletcher, President of the Ottawa Naturalists' Field Club, would be happy to send specimens of Canadian plants to any member wishing to study them.

The Secretary called attention to the work which is being done by the Essex Bee-keepers' Association, and distributed some copies of the prospectus and rules of that Society.

Mr. B. G. Cole exhibited a specimen of *Abraxas Ulmata*, taken by himself in Bury Wood, Epping Forest, last July. He had not previously heard of the occurrence of the moth in the Forest. Mr. Cansdale informed him that the species had been taken at St. Osyth, Essex. He also exhibited a remarkably small specimen of *Liparis auriflua* (the Gold-tailed Moth), taken at large near Loughton, in July last. This dwarf was less than half the normal size of the species.

Mr. H. A. Cole exhibited and presented to the Museum two worked flints which he had recently found. The most perfect one was from Great Parndon, Essex. Near that village he had come upon a heap of stones which had been picked off the neighbouring fields. This heap contained a considerable number of ordinary glacial fossils, *Gryphea*, *Echinus*, lumps of lime-stone, &c., with chalk-flints and fragments of rock of various kinds. On carefully searching the heap he had found a flint bearing evident marks of human workmanship. Judging from its form it had probably been hafted to a handle and used as an adze in agricultural operations. The specimen had been shown to Dr. Evans and General Pitt-Rivers. The second flint Mr. Cole had picked up in the Epping New Road, near High Beach, from a heap of gravel by the road-side, which had probably been dug from the Forest pits close by. The celt was a very rude one, and was quite white upon its surface, an appearance probably due to aqueous action, the soluble particles having been removed by the infiltration of water through the body of the flint, while the insoluble portions had been left in a finely divided state, and consequently reflected white light.

The President said that those disposed to hunt for these interesting relics of a time long past might take a hint from these finds of Mr. Cole. The last remnants of the "Stone Age" were to be found scattered over the surface of the country in ploughed fields, &c., and as stones were often gathered by farmers from the fields, it might be profitable to submit the spoil-heaps to a rigorous examination when found in suitable localities.

Mr. W. Cole showed several species of Coleoptera, including the scarce Rose-beetle, *Gnorimus nobilis*, which he had found on bramble blossom in Lodge Bushes, Epping Forest, in July last. He also exhibited some specimens of Essex insects, Hymenoptera, Diptera, Coleoptera, &c., sent by Mr. Billups to illustrate the modern methods of preparing insects for

the cabinet. Also a box containing "life-histories" of several species of moths, showing caterpillar, chrysalis, cocoon, imago, parasites, &c., in one view, which he had prepared as a kind of ensample of the biological collections he would like to see in the Club's Museum.

Mr. Crouch said that he was much interested in Mr. Cole's specimens, inasmuch as they illustrated a principle he had long maintained as the right one to be followed in a collection intended to be of educational value, viz., the demonstration of the structure of an animal in all its stages, and not merely of one phase of its development. He had endeavoured to carry out the plan in his own special study, conchology, which was too often looked upon as a kind of artificial classification of an important group of animals by means of one very superficial feature in their organisation, the shell or protective envelope of the body. He hoped soon to be able to submit to the Club some specimens which would illustrate in a measure his views on the subject.

A paper "On the Land and Fresh-water Mollusca of the district around Colchester," by Mr. Henry Laver, F.L.S., was read by the Secretary. [Transactions, ii. 88.]

The President observed that Mr. Laver's paper appeared to be of considerable value as embodying the result of close personal observation in a limited area, and as giving so much precise information as to the environment of each species. He took it that the paper was typical of the kind of communications they desired to have in the 'Transactions' of the Society, and he had only one suggestion to make, viz., that authors could add much to the interest and value of their communications by exhibiting the specimens described, and, if possible, placing an authenticated series in the Museum of the Club, so as to be available for future reference.

Mr. Walter Crouch said he had listened to Mr. Laver's paper with much pleasure, and could but echo the wish of the President that the author had sent specimens of the various shells. It was curious to note that some of the genera and species which were very common in the Beacontree Hundred had not, so far, been found by Mr. Laver in his district. Mr. Crouch instanced the genus *Vertigo*, species of which are extremely difficult to find on account of their minute size, and of which he had obtained some thirty specimens that season, embracing certainly three or four of the species; and *Physa hypnorum*, which, though rare with the author, was one of the commonest shells in the meadow grips in his own district. He had seen this shell and that of *Limnæa peregra* in scores, left high and dry after a flood in the Roding Valley. On the other hand, the pretty little land snails, *Helix aculeata* and *Achatina acicula* he had never had the good fortune to find; and though the river snail, *Paludina vivipara*, was extremely common in the Roding, it was not mentioned by Mr. Laver, while the other species, *P. contecta*, which Mr. Crouch had never found in Essex, was stated to be found in the Stour, and of very large size. *Balia perversa* was rare in both

districts, and he had only found two specimens. For the genus *Clausilia* he had been searching, and felt sure it existed in the district, as he once found after a flood one broken shell of *C. rugosa* (?) washed down into the river at Barking Side, but he had not met with a perfect shell. He might also add that, without opening up the old and vexed question whether *Helix nemoralis* and *H. hortensis* were distinct species, he had found with Mr. Laver that where one was common the other was not. He had examined that year some 500 or 600 specimens of the former at Barking Side and found not a single white-lip, while at Leytonstone and other places he could always find *hortensis* and never a brown-lip.

A paper by Professor Boulger "On the River-basins of Essex as Natural-history provinces," being an appendix to his paper read at the Chelmsford Meeting, was read [Transactions, ii. 79.] The paper was accompanied by a sketch map of the county, showing proposed natural-history provinces, and the author requested the kind assistance of residents and others in determining the nomenclature of various small streams which were unnamed in any maps to which he had access.

Various observations respecting the maps of the county and other sources of information were made by Messrs. Fisher Unwin and Crouch, and cordial votes of thanks were passed to Mr. Laver and Prof. Boulger for their papers.

The President referred to the Conference of Local Scientific Societies held at the York Meeting of the British Association, which he had attended as delegate on behalf of the Club. Suggestions had been made as to work which could be carried on by local societies, but speaking on behalf of their own Club he thought that the line of action they had adopted would give the society plenty of good opportunities for work during the next few years.

At the Conversazione, Mr. Oxley, F.R.M.S., exhibited a fine series of doubly-stained sections of various vegetable stems under the microscope; Mr. English a long series of fresh specimens of Fungi, named and arranged with great care, including a specimen of the rare *Helvella lacunosa* from Epping Forest; Mr. W. Crouch a long series of "varieties" or aberrations of *Helix aspersa* and *nemoralis;* and Mr. Oldham some specimens of sand strata from Ipswich.

Saturday, October 1st, 1881.—Annual Cryptogamic Meeting, and Ordinary Meeting.

[*Mr. Worthington Smith has kindly allowed us to use the humorous report of our Meeting, written by him for the 'Gardeners' Chronicle' of October 8th, 1881. A few necessary additions and alterations have been inserted, but in the main the report is in Mr. Smith's own words. The list of Mosses, Hepaticæ, and Lichens, is given on the authority of Mr. E. M. Holmes, F.L.S.*—Ed.]

To Mr. Malcolm McLean, Gardener to J. Whatman, Esq., Vinters Park, Maidstone, belongs the honour of sending the champion fungus of the year for exhibition at our Annual Fungus Meeting. His name and address should be preserved in the archives of fungology for ever. A letter preceded the fungus stating that it was very big, that it had grown at the base of a Scotch Fir, and had only once before been seen in Vinters Park. The request to send the fungus up was at once complied with, and it came in an enormous deal box (now a spacious and luxurious rabbit-hutch) painfully carried by two men. On opening the box a delectable fragrance poured out, and on removing the shavings a stupendous specimen of the rare and edible *Sparassis crispa* was seen—such a specimen as had probably never before gladdened the eyes of any fungologist. A common size for *Sparassis* is that of an orange, or possibly a small round melon, but here was an example of massive and cyclopean proportions—three feet six inches round, ten inches high, and with a solid rooting base six inches deep. As far as the writer knows, such another specimen has never been seen or even dreamed of "in tale or history." It was no easy matter to get this fungus to Loughton, but after all the rooting portion had been cut away it was divided into two pieces, and dropped into a couple of large open fish-baskets. These baskets the writer took by hand to Liverpool Street, very much in the style of an itinerant street vendor of sponges, with a very large stock-in-trade. The first person met at the station was Dr. Spurrell, who, with quick geologic eye, took the cream-coloured, sponge-like masses for a series of magnificent examples of teeth of *Elephas primigenius*, which indeed they very much resembled; but the ambrosial fragrance, so different from that pertaining to elephant's teeth, soon advised him of the true nature of the treasure. Two fungologists carried the fish-baskets to the "Crown" Hotel, and lovingly placed the *Sparassis* in the room set apart for the exhibition of the day.

This second "Fungus Foray" of our Club, in welcome contrast to the first, was held under very favourable meteorological conditions: the day was such as one would have chosen—warm, bright, and delightful. Seen in the brilliant sunshine, the woods of Epping Forest presented some charming features of colour and form, and the special objects of our search were abundant, although a few species were perhaps a little *passé*, the fungus season, at least in the Forest, having opened somewhat earlier than usual. The band of experts invited by the Secretary to act as leaders and advisers was remarkably comprehensive. Dr. M. C. Cooke was one of the first fungographers to arrive at Loughton, accompanied by Dr. H. T. Wharton; soon after Dr. Braithwaite was on the spot, with Mr. W. W. Reeves, Dr. Spurrell, Mr. Worthington Smith, Mr. A. Heath, Mr. J. A. Johnson, and many other professional or amateur botanists. Seventy members and friends had sent in their names as desiring to be present, but more than a hundred persons actually attended. Mr. English's local knowledge was very useful, and Mr. E. M. Holmes being

also with the party, Cryptogamic Botany in all its branches was well represented.

The section of the Forest searched included the district of High Beach, Great and Little Monk Woods, and the Woods near Theydon Bois. The gatherings were very large, and in the presence of such a band of accomplished botanists very few species went unnamed. The ladies of the party set out their spoils in open baskets with moss and fern, thereby revealing the wealth of colour and beauty that is to be found in the commonly despised mushrooms. Many of the baskets would vie in appearance with the finest bouquets, and they afforded hints for the decoration of rooms at seasons when flowers are not abundant, for an hour's gathering would furnish a collection of brilliantly coloured forms with which an artist might be enraptured.

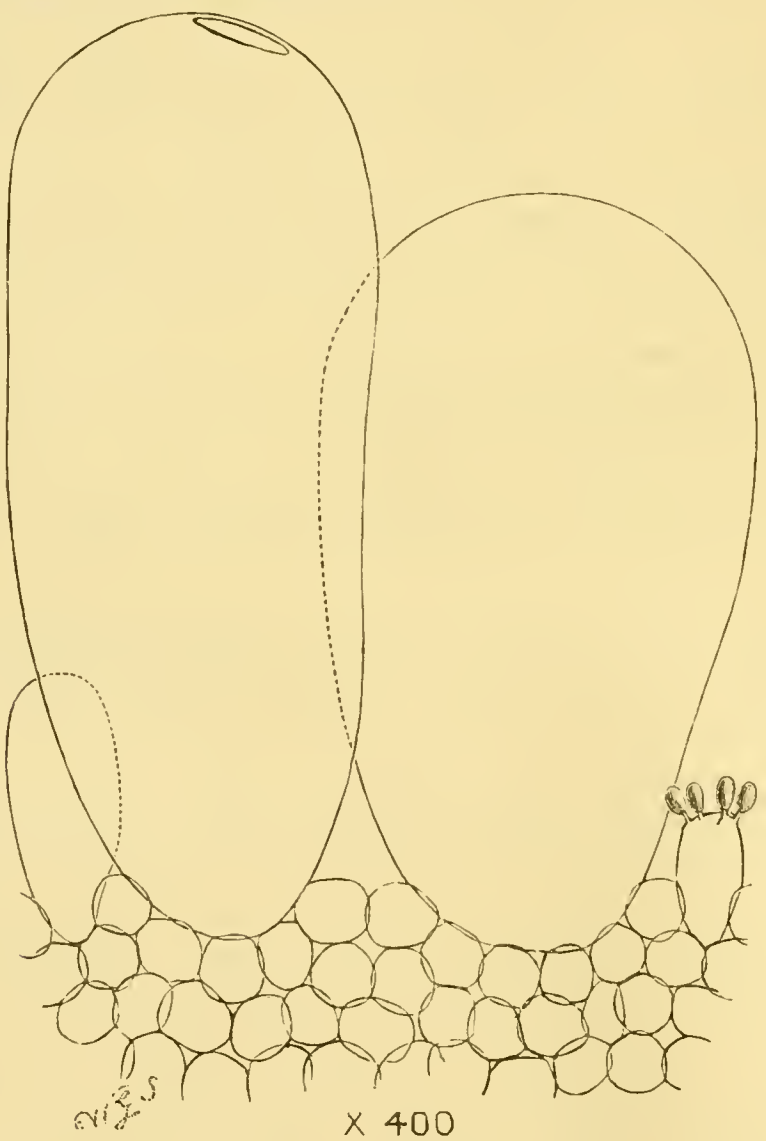
Hygrophorus eburneus was very abundant, a white and sticky species, said to be edible; a close ally and "consort" of this plant was also frequent in *H. cossus:* the latter is much more glutinous, its top is slimy, and the whole plant is rich in the potent odour of the he-goat, or—to those who are not fortunate enough to know this odour—the scent of the larva of the Goat Moth (*Cossus ligniperda*). The viscid tops of the specimens of *H. cossus* were covered with dead flies, at first probably attracted by the odour and then caught and suffocated by the gluten. Some of the younger members claimed these Fungi as undoubtedly "carnivorous plants"; they carefully placed them in their baskets, determined (they said) to look for and find pepsine, distended fungus-cells, and digestive cavities! Another handsome ally is *H. chrysodon:* this was once or twice met with; the plant is named "*chrysodon*" from its fancied resemblance in colour to the beautiful golden-greenish stone named "*chrysolite.*" One gentleman found a vegetable beaf-steak, *Fistulina hepatica;* and another botanist, who had gathered one the day before, brought it to the Forest cut up in slices between bread in the form of sandwiches. This was an inveterate fungus-eater, for he even dispensed with mustard, and secured the necessary pungency by the insertion of thin slices of the fiery *Lactarius piperatus.* We cannot all go to such lengths! One or two specimens of the gorgeous vermilion-coloured *Cortinarius cinnabarinus* were found with many examples of its handsome, but more soberly tinted ally, *C. cinnamomeus. Agaricus rubescens* was very frequent; this plant is commonly said to be edible, although Mr. Berkeley cautiously omits any reference to its esculent qualities. Dr. Wharton stated that this plant is not only good for food, but is excellent for its production of a refined and appetising ketchup, not so rich as that peculiar to the mushroom, but a delicate nepenthe, fit for the gods. The beautiful "consort" of *Agaricus rubescens* was present in *A. pantherinus*, perhaps as edible as the last, but seldom or never changing to sienna-red when broken or bruised. The golden-yellow edible Chantarelle, *Cantharellus cibarius*, was frequent; so also was its duller-coloured but more elegant ally, *C. tubæformis. Russulas*, so called because many of the species are red in colour, were

extremely abundant and very difficult to determine; some are very tender, some very tough; some fleshy, others almost woody; some with an inseparable cuticle, others with a separable one; some white and some red under the cuticle; some mild and innocent, some so intolerably pungent that if placed on the tongue, the skin of that delicate organ will speedily peel off with a blister, and (like *Russula emetica*) show red underneath! The lovely but untouchably glutinous *Agaricus mucidus*, generally so frequent on the High Beach beeches, was this year nowhere to be seen. The Falstaffean *Boletus edulis* was common, as well as *B. chrysenteron* and *B. subtomentosus*. The milk mushrooms, *Lactarii*, were abundant; the poisonous, livid, *Lactarius lividus*, was everywhere; *L. quietus*, so mild that none need fear his quietus from consuming it, was also very common; "odour oily—like bugs," writes Mr. Berkeley; other authorities say the odour is "mealy, like recent farina." Perhaps the "mealy-bug" was in view, but this is not stated! *Boletus scaber*, grey, ugly, sticky, and vile to the sight, albeit an edible species, was to be noted almost everywhere; and *B. luridus* was frequent, rapidly changing to blue when cut or broken—a pretty toy for the ladies, quickly poisonous to some people, but a delicious viand to the indurated hippogastrous fungophagist. We must not, however, weary our readers by attempting a catalogue of all the species met with; a list of the forest Hymenomycetes as far as at present ascertained, is given in this part of the 'Transactions'; most of them are common in the woods every autumn, and many were recorded in the account of last year's fungological ramble [Proceedings, i. xlviii.]

Many of the visitors were struck with the beauty and luxuriance of the golden *Peziza aurantia*, growing in large patches in and about the road ruts and newly-cut water-courses, particularly in Fairmead Bottom and near Golding's Hill.

But one remarkable fungus certainly demands a special paragraph in our records, viz., *Coprinus aratus*. This is probably a rarity, and has not been seen by the writer for the last twenty years. Mr. Berkeley first found it "in a hollow tree." It was one of the first Fungi to attract our notice when commencing the observation of the Cryptogamia, growing twenty years ago at the bottom of a dung-heap in Nottinghamshire. *Coprinus aratus* is one of the larger, deliquescent, fugitive species; it grows to be six inches high, stem tapering upwards, very hollow and fragile, a top from three to five inches across, tender, and breaking to pieces with a touch. It lives less than a day, and in decay it curls up into beautiful volutes, and distils itself away into drops of black and tumid ink. Dr. Wharton had the pleasure of discovering the specimen in Monk Wood, which was, alas! but a ruin, suffering from a dread and fatal mycoclysm; however, the remnants were brought carefully home for the microscopic examination of the *cystidia*. As these organs (concerning the exact nature of which much difference of opinion prevails, although Dr. Cooke states that the evidence seems to be in favour of the

view that cystidia are barren conditions of the ordinary spore-bearing structures or basidia) are more developed in *C. aratus* than in any other species yet examined, an illustration is here given, for the loan of which we are indebted to the courtesy of the Editor of the 'Gardeners' Chronicle.' The ordinary cells of the plant are seen at the base of the figure—a basidium with its four spores on the right, and two of the gigantic cells, termed cystidia, occupy the body of the illustration. It is a curious fact that all the cystidia in the specimen examined grew on the gills close to the insertion of the stem, and none were to be found towards the edge of the cap; they may have dropped to the ground from this part of the plant with the falling spores.



Cystidia of *Coprinus aratus*.

The other classes of Cryptogamia were attended to by Dr. Braithwaite and Mr. E. M. Holmes. We have no report from the former gentleman, but Mr. E. M. Holmes has furnished the Secretary with the following lists of Lichens, Mosses and Scale-Mosses met with during the day, and has kindly deposited the specimens on which the lists are founded in the Club's Museum for future reference. The area of collecting was in the

neighbourhood of the "Green Ride," from Staples Hill to Monk Wood, and more particularly in the latter place.

Lichenes (named in accordance with Rev. W. A. Leighton's 'Lichen Flora of Great Britain,' 2nd Edition):—

Calicium hyperellum. On old trunks, Monk Wood.
Cladina rangiferina.
Cladonia pyxidata.
Evernia prunastri.
Parmelia olivacea.
Parmelia physodes.
P. saxatilis. Monk Wood.
Pertusaria communis. Monk Wood.
Lecidea (Griffithii) tricolor. Monk Wood.

Hepaticæ (named in accordance with Dr. Cooke's 'British Hepaticæ'):—

Jungermannia albicans.
J. ventricosa.
Lophocolea bidentata.
L. heterophylla. Monk Wood.
Fossombronia pusilla. On the banks of the stream crossing the Green Ride near Debden Slade.

Musci (named in accordance with the 'London Catalogue of British Mosses,' 2nd Edition, 1881):—

Weissia cirrhata.
Dicranella heteromalla. Monk Wood.
Dicranum majus.
D. palustre.
Campylopus flexuosus. Monk Wood, in fruit.
C. pyriformis.
Leucobryum glaucum. Monk Wood.
Pleuridium nitidum. On banks of stream crossing Green Ride, near Debden Slade; also in Monk Wood.
Mnium hornum.
Tetraphis pellucida.
Polytrichum formosum. Monk Wood, &c.
Neckera complanata. Growing with *Hypnum cupressiforme.*
Thuidium tamariscinum.
Eurhynchium myosuroides.
Plagiothecium undulatum. Monk Wood.
Hypnum cupressiforme.
H. purum.
Hylocomium splendens.

Owing to the attractions of the Fungi the Phanerogamia were but little noticed, the only plant gathered worth recording being *Gnaphalium sylvaticum*, which was growing plentifully in the open gravelly ground near Monk Wood. Mr. Saville Kent was with us, ready to afford information to the student of minute life in the searching of ponds and ditches, but no report of captures has reached us. Mr. Kent found some forms of the dubious Myxomycetes, concerning the fungoid or infusorial nature of which so much discussion has recently taken place.

As dusk began to fall the large party made towards the "Crown" Hotel, Loughton; everyone being furnished with ample stores of specimens. Arrived at the Inn, the bags and boxes were carefully emptied and the Fungi ranged in due order in the room set apart for the exhibition, and then came the usual Club tea.

After tea the 20th Ordinary Meeting of the Club was held, the President in the Chair.

The following were elected members :—Messrs. Garrad Baker, Frederic Chancellor, F. R. Harold, F.S.S., F. H. Hempleman, F. J. V. James, Charles A. Onley Marsham, J.P., G. H. Raynor, M.A., and W. H. Stead.

On the motion of the President a cordial vote of thanks was passed to the distinguished botanists who had so kindly acted as leaders and advisers during the day.

On the circular calling the Meeting, a short address, to be entitled "Half-an-hour with the Fungi of the Loughton District," had been set down to Dr. Cooke. He said, however, that when he promised to give that address it was before a sad calamity fell upon him, which had prevented him for some months from paying any attention to affairs in which the mind or hand had to be engaged. Under other circumstances he should have been extremely happy to have carried out his promise, and to have read a paper. But as that was the first time for two or three months on which he had attempted to address an audience, they would accept that as an apology for not carrying out to the full extent the promise he gave. He had intended to give a *résumé* of such Fungi as he knew to be, or such as had been recorded to have been found around Loughton, or in Epping Forest. He had thought that such a list, if rendered complete, as it could be, would be a very useful one to be included in their 'Transactions,' since no list, so far as he knew, of the Fungi of Essex, had ever been collated or published. Dr. Cooke then referred to several Fungi noted by Sowerby as found in the Forest, and called attention to a paper contributed by Mr. English to the 'Transactions' of the Essex Field Club. He intended to write out a list of the Forest species, and submit it to an early meeting of the Society. After referring particularly to several of the more remarkable species, Dr. Cooke went on to urge that the Forest should be systematically scoured ; if everybody in that room were to set about the work for twelve months what a number of new species they would have, or if not new species, yet species that were only hitherto known as occurring upon the Continent. Do not let them think that there were fewer Fungi in Epping Forest than in Herefordshire, or in any other part of England. He believed there were as many, and that as long a list could be made out, and he doubted not that at least two-thirds of English species—and more—could be found in the Essex Woodlands. [Applause]. In mentioning the species peculiar to the Forest, Dr. Cooke inadvertently omitted the lovely, but sticky, little *Agaricus Worthingtonii*, so named by Elias Fries, in honour of the writer of this record, and of Epping Forest. *A. Worthingtonii* is peculiar at present to the Forest, and long may it remain so : the original Friesian MS. description is in possession of the Club.

Mr. Worthington Smith followed with some remarks upon special Forest species, and some elementary hints as to the modes to be adopted in identifying Fungi ; then Dr. Braithwaite spoke of the mosses of Epping Forest, and of mosses in general, and how to find and study them. Mr. E. M. Holmes had brought with him some excellent diagrams illustrating

most of the largest families of British Mosses, as well as some type specimens, which were on exhibition, and which are now deposited in the Museum of the Club. He also exhibited specimens demonstrating the principal groups of British Lichens, and explained the leading characteristics of each. He expressed himself as being somewhat disappointed with the lichens he had met with in that day's excursion, and believed that those who wished to explore the Lichen Flora of the county must go farther afield. A number of rare lichens had been found by Mr. E. G. Varenne, in the neighbourhood of Kelvedon, and he felt sure that a very good list might be made out if Essex were systematically searched. So far as his experience went it was of little use to look for lichens within twenty miles of London. The immense volumes of smoke sent up by the great city seemed to influence the atmosphere (probably being carried by the prevailing winds) to that distance. The existence of lichens in a healthy state on trees indicated a pure moist air. Lichens also liked wind and light, consequently the trees on the outskirts of woods were generally better clothed with them than those in the interior. These facts seemed to militate against the Algal-Fungus (or Schwendenerian) theory of lichens; since Fungi as a rule shun the light, and moreover they are with few exceptions ephemeral plants, while lichens are of very slow growth and endure for many years. Fungi might be noticed in abundance in the immediate neighbourhood of London, but lichens could not be found in a perfect or healthy condition within many miles of that city. It was true that *Lecanora galactina* might be found on Kew Bridge or on walls in the Caledonian Road; but it speedily disappeared and became replaced by mosses. It was a remarkable fact that hardly any lichenologists believed in the Schwendenerian hypothesis, although it was accepted by several vegetable physiologists of high repute. It was very instructive to observe the stages in the growth of lichens in the course of a walk from London towards the country. First the gonidial (or algal?) state was met with on trees, and then evidently the same plant showed an imperfect thallus, and at last the perfect thallus and the fructification were met with at a sufficient distance from town. If the lichen be a compound of fungus and alga, it is the alga that appears nearest to London, and not, as might be supposed, the fungus. Mr. Holmes had observed this development in the case of *Lecidea canescens* in the course of a walk from Chislehurst to Chelsfield. But although the list of lichens in Epping Forest was certain to be a meagre one, the Moss Flora would probably well repay examination, judging from the specimens met with during the day.

The party then adjourned to the exhibition room, where an hour or so was agreeably and instructively spent in examining and determining the large number of Fungi there displayed. Part of the gigantic *Sparassis* had mysteriously disappeared (*vide* 'Gardeners' Chronicle'), but enough remained to allow many mycologists to carry off slices as mementos of our Fungus Foray of 1881.

SATURDAY, OCTOBER 29TH, 1881.—ORDINARY MEETING.

The 21st Ordinary Meeting was held at the Head-quarters at seven o'clock, the President in the Chair.

Donations of books or pamphlets were announced from Messrs. E. Brown, S. N. Carvalho, B. G. Cole, R. Meldola, and Miss M. S. Ridley. Various specimens for the Museum were contributed by Messrs. English, Travis, White, and E. M. Holmes, F.L.S. A unanimous vote of thanks to the donors was passed.

The following persons were balloted for and elected members of the Club :—Lord Eustace Cecil, M.P., Sir H. J. Selwin-Ibbetson, Bart., M.P., Miss Marian Ridley, and Edward Unwin.

The President announced that at the York Meeting of the British Association, the Report on the Excavations at Ambresbury Banks had been read, and that subsequently the Secretary had received the following communication from Prof. Bonney :—

"British Association for the Advancement of Science,
"22, Albemarle Street, W.,
"13th October, 1881.

"Sir,

"I am directed by the General Committee of the British Association for the Advancement of Science, to transmit to you the following Copy of a Resolution, which was adopted by the Committee at the last Meeting of the Association, and to request your attention thereto :—

"*That Mr. R. Meldola, General Pitt-Rivers, and Mr. Wm. Cole, be a Committee, for the purpose of investigating the ancient earthwork in Epping Forest, known as Loughton Camp; and that Mr. W. Cole be the Secretary.*

"I have the honour to be,
"Your very obedient Servant,
"T. G. BONNEY, *Secretary.*

"To W. Cole, Esq."

He thought that the Club might be congratulated on receiving this recognition of its work at the hands of such an influential body as the British Association, and he hoped it would prove an incentive to the members to support the Society in the course of action it had struck out for itself.

Three communications stood for discussion upon the Agenda paper ; Mr. Fitch asked permission to take his essay first as he had to return to Maldon that evening. The paper, entitled "The Galls of Essex," [Transactions, ii. 98], was then read by the author. Mr. Fitch illustrated his memoir during its delivery by the exhibition of various coloured plates contained in Dr. Adler's essay and other German publications, and by references to his own extensive collection of galls and gall-making insects, with their inquilines and parasites, which he had brought with him, and which was on view in one of the meeting rooms.

The President, at the conclusion of the paper, said he was sure all the members of the Club would agree with him that they were much indebted to their Vice-President for his admirable treatment of a subject which presented so many points of interest to them all, and one which Mr. Fitch had for many years made a special study. In addition to the important list of the galls of their county, the author had given a most valuable introduction containing a *résumé* of the different theories of the cause of galls which had been propounded; and he (the President) felt sure that a subject which appealed to so many different classes of their members—to their zoologists, botanists, and general biologists—would be warmly taken up. The President thought that the best compliment they could pay to Mr. Fitch would be to discuss the subject thoroughly; and in inviting observations upon it he felt confident that the author would be only too glad to reply to any questions that might be put to him.

A long discussion then took place with reference to various points in the history of galls touched upon in the paper.

Dr. Pearce took exception to Sir James Paget's opinion that there was an analogy between the growth of galls on plants and the morbid processes exhibited in many diseases of the human subject, but before considering that point, he wished, as a new member of the Club, to express the pleasure with which he had listened to Mr. Fitch's paper; he had never heard a more complete bringing together of a multitude of facts and observations than that which the essayist had presented to them that night. Returning to the allusion in the paper to the inoculation of the human system with the several "viruses"—such as variola, vaccina, cancer, syphilis, and other inoculable and constitutional diseases—he understood the essayist to state that the formation of galls in the vegetable kingdom bore a resemblance to the action of the said viruses in the animal system. In his (Dr. Pearce's) opinion a distinct line must be drawn between the two classes of phenomena; and while there was some dispute amongst biologists as to whether galls were due to the mechanical irritation of the egg, or to the introduction with it of some stimulating fluid by the insect which tended to produce the galls, there was still no real analogy between their production and the results following an inoculation with animal virus. On a tree the egg of a gall insect might be immediately productive of a morbid growth—a gall limited to a given spot, and not affecting the life or disturbing the general condition of the plant. In the case of inoculating, whether with variola (small-pox) or vaccina (cow-pox), a process of fermentation is set up, permeating and affecting the whole system—giving evidence of its existence after the lapse of a certain fixed number of days, by the appearance in vaccina of a vesicle at the seat of inoculation, or, as in the case of variola, developing on every part of the surface of the body hundreds of vesicles, which ultimately become pustules. He further remarked that there did not reasonably appear to be a resemblance between galls in the vegetable kingdom and certain skin diseases incident to the *genus homo*, children more

especially. These he thought partook of a vegetative or fungoid, parasitical nature, and were clearly distinct in their origin and development from true galls produced by insects.

Mr. Letchford called attention to the very remarkable chemical substances found in abundance in the tissues of many galls. These substances appeared to exist in the sap of the trees, but became concentrated in the galls, and seemed to be a necessary concomitant of their growth.

Mr. Henry Walker gave some details as to the morphological structure of galls, and alluded to the appearance of the Devonshire or "Marble-gall" (*Cynips Kollari*), near London, within living memory. Many years ago the late Frederick Smith put a large quantity of these galls into Highgate Wood, and he thought it was possible that the rapid spread of the marble-gall might have had some connection with that circumstance. Mr. Walker also called attention to the bearing of the very remarkable observations of Dr. Adler as to the existence of di-morphism in galls upon the current theories of evolution.

Mr. Meldola stated that there had always appeared to him one difficulty in connection with the mechanical theory of galls which he would be glad to see explained. He did not wish his remarks to be considered in any way critical, but he could not help feeling that there was an objection which Mr. Fitch would perhaps throw some light upon. In accordance with what he would call the purely mechanical theory of galls these growths were caused by the presence of the egg of the insect laid in the leaf-tissue or other part of the plant, and acting as a local irritant. He could easily understand how on this view differently formed galls might result from the irritating action of eggs laid in different parts of the plant, but he could not see how on this theory it was possible to account for the fact that on the leaves of the same plant a large number of insects could each give rise to a differently formed gall. It had been proved that the egg continued to grow for some time within the gall, but this did not appear to him sufficient to explain the fact mentioned. A different form of egg, and a different rate of growth for each species, was assumed, but this was so far only an assumption; experimental and observational proofs were required in order to demonstrate conclusively that there existed a connection between the form and rate of growth of the egg and the form of the gall. As to the points raised by Mr. Walker, Mr. Meldola said that he had lately been working at them, and hoped to address some remarks upon the subject to the Club at the Annual Meeting.

In reply, Mr. Fitch stated, with reference to Dr. Pearce's remarks, that Sir James Paget, in making his comparisons, had expressly noted the great contrasts between the pathology of animals and plants. From his own point of view also it was by no means intended to institute a comparison between the special viruses which we know are capable of being artificially introduced into the human body, or with

our own specific diseases. We must remember that the sap-flow in plants is by no means analogous to the circulation of the blood in animals, and there is an absence of the complex nervous system. A nearer analogy might be traced in the known specific action of various blisters and irritants, or in the production of local abscesses, festers, or like simple humours, from the inflammation set up by the irritating presence of some foreign substance. Mr. Fitch said that although a firm believer in the mechanical oval and larval irritation theory, he thought it probable that the application or removal of pressure, the stimulated growth to throw off the foreign substance introduced, and other secondary causes, also came into play. He had referred to the production of warts, and to make a rough comparison he would instance a hairy wart in which we found an excessive development of cuticle and an increased development of the vascular secretory structure, with the exudation of an abundant quantity of fluid, causing the extra growth of hairs; compare this with the familiar "Robin's pin-cushion," or Bedeguar gall of the rose, where we had excessive development and thickening of cambium tissue and bark with an increased afflux of nutritive matter, resulting in the enormously developed growth of leaves, remembering that the so-called "hairs" with which the gall is covered are really leaves abnormally developed, with scarcely any parenchyma between their fibro-vascular bundles. Dr. Pearce must also remember that we are not yet by any means fully acquainted with the relationship between the formative stimulus (mechanical or otherwise) and the supporter of the stimulus; this also answered, or rather failed to answer, our President's question as to why the galls, quite constant in themselves, which occur in exactly similar situations should exhibit such varied forms. Our present knowledge was not able to give a ready solution to this involved problem, but we know that there are still many well-known but ill-explained facts in both animal and vegetable pathology. Mr. Fitch expressed a hope that some of the structural botanists in the Club would turn their attention to these important and interesting points.

The analogy between the various skin diseases in the human subject attributable to fungoid presence, and the numerous varied and well-marked fungoid vegetable galls, alluded to by Dr. Pearce, stood on a similar footing, but with a more perfect concatenation. The subject of the useful chemical properties, remarked upon by Mr. Letchford, was of true commercial importance, and deserved more attention in this country than it at present received. The tannic and gallic acids were undoubtedly more concentrated in the substance of certain oak-galls than in the oak bark itself; but why we should annually import from £70,000 to £80,000 worth of galls for tanning purposes, while our own large crop of oak marble-galls is unmarketable except for the manufacture of rustic baskets and similar trinkets, requires further explanation. Chemical analysis hardly warrants this neglect of our native galls. Mr. Fitch

added that the question put by Mr. Walker, as to whether in the Cynipidæ alluded to we had a case of evolution *per saltum*, opened a very wide field for discussion, and one which had better perhaps be deferred or left in the able hands of the President. He would however observe that the dimorphic theory really only implied travelling on a double line of rails instead of a single one. The dimorphic forms were both constant in themselves; but the tendency to variation, the break of unity in habits, and the production of a temporary new form, were remarkable facts, and well deserved every attention from the biologist.

At the close of the discussion a hearty vote of thanks was accorded to Mr. Fitch for his valuable paper.

Sir T. Fowell Buxton, Bart., communicated the following:—

"Notes on the Occurrence of a Honey Buzzard (*Pernis apivorus*) in Epping Forest.

"I think it worth while to mention and record that I yesterday and again this morning (Saturday, September 24th, 1881), saw a Honey-Buzzard in the Forest. It rose from a bush of beech close to my feet, and flew with rather a heavy flight to an oak about twenty yards off, where it remained for a few seconds. On examining the bush I found it swarming with wasps, which began to fly out on my touching the bushes. I then found pieces of wasps' comb lying on the ground outside the bush, and the dead leaves scattered around.

"This morning (September 24th), on approaching the spot, we again saw the bird flying over the trees away from us. Much more of the wasps' comb was lying about, and a large cavity could be seen under the branches where the nest had evidently been scratched up, and the contents strewn around. The branches of the bush showed no signs of injury, as they would have done had any man disturbed the nest. The account of the bird in Gould's 'British Birds,' leaves no doubt that the name is correctly given. The spot was about thirty yards from and above the spring, E.S.E., on the Woodredon Hill.

"The bird was again seen, by Mr. Andrew Johnston and myself, on September 25th during the afternoon, as it was rising from the same wasps' nest as before. It was thus seen on three days consecutively. I hope the place will not become so well known as to risk its being trapped.

"On visiting the spot on the 28th the Buzzard seemed to have left the place, but the remains of the wasps' nest were clearly visible at the side of the hole, grubbed up by the Buzzard as I suppose."

Under date October 19th, Sir Fowell Buxton adds:—

"On coming to Norfolk, I find from Mr. J. H. Gurney, of Northrepps (near Cromer), and others, that there have been noticed some twelve or more of this species, as well as common Buzzards. He has three alive which have been caught in this neighbourhood (Cromer), and some have been picked up dead on the shore near Yarmouth. Mr. Gurney believes that all the larger Hawks are young birds of this year."

Mr. R. M. Christy, of Saffron Walden, sent the following under date October 26th, 1881:—

"Notes on the Occurrence of the Honey Buzzard (*P. apivorus*) at Great Chesterford, and at Saffron Walden, Essex; and of a Common Buzzard (*Buteo vulgaris*) in Shortgrove Park, Saffron Walden.

"It appears that a considerable number of the larger birds of prey have been killed this autumn during their southward migration. No less than three Buzzards (two Honey Buzzards and one Common Buzzard) have been shot within a short distance of this town, and, through the kindness of our member Mr. J. Travis, to whom two of them were sent for preservation, I am enabled to give the following short account of them :—The first Honey Buzzard was shot, as briefly recorded in the 'Field,' in the Rectory Garden at Great Chesterford, on September 26th last, by Mr. G. Ernest, a son-in-law (?) of the Rev. E. Seymour Randolph, the clergyman there. According to his account the bird rose from near a large wasps' nest, but that it had been feeding on either the wasps or their grubs I very much doubt, as Mr. Travis and I, on examining the contents of its stomach, found nothing of the kind. The substance we met with was not in a very recognisable condition, but it appeared to consist principally of the remains of grasshoppers, with small beetles, and probably some other insects intermixed. The bird is, I think, a young male; the body was coated thickly with fat; the sides were brown, and the legs and cere bright yellow. The plumage is of an almost uniform reddish brown colour, scarcely varied except by some darker bars across the tail, and a whitish tip to each of the feathers in it. There is also a greyish tinge on the feathers in front of the eye. This bird is certainly the most un-hawk-like of all our Falconidæ. The head and beak are small; the latter being very neatly formed and sharp, and nearly black in colour. The wings are small even for a Buzzard, and the claws weak and very slightly hooked. The sternum does not exhibit any noticeable peculiarity when compared with that of other Buzzards, though the keel is rather deeper. Its structure generally is well adapted to its necessities and mode of life.

"Of the other Honey Buzzard I can give but little information. It was shot about the same time as the one above referred to, by one of Lord Braybrooke's keepers, near the aviary at Audley End. As it is now being stuffed in London for His Lordship's collection I do not know its age or sex, but it is stated to have been rising from a wasps' nest when shot at and killed.

"The Common Buzzard was shot by one of the keepers in Short Grove Park, close to Saffron Walden, about the 5th or 6th of October; it is a handsomely plumaged male bird, which Mr. Travis has mounted. In its stomach I found the remains of a rat, and there was more of the same substance in the crop, from which Mr. Travis had previously taken a couple of Field-mice.

"While upon the subject of Hawks, it will, I think, be as well to give a few particulars which Mr. Travis has been good enough to furnish me with concerning several which have been shot in this neighbourhood in years gone by, and which have never been recorded, or only very inadequately.

"The first of these is a Honey Buzzard which was seen several times about a certain spot near Littlebury Green, one September about five years ago, and was at last shot by Mr. Newman, of Strethall Hall, bailiff to Mr. Edmund Emson, in whose possession it now is. When shot it was as usual engaged upon a wasps' nest. It seems to have been an old male bird, with bright yellow irides, and its cheeks ashy coloured, but otherwise much the same in plumage as the one already described.

"Forty years ago Mr. Travis himself, then a resident close to the aviary at Audley End, was sitting at breakfast one morning during the last half of September, when he saw a large hawk fly by, and, following it immediately with his gun, soon shot it as it sat upon a tree. No particulars seem to have been preserved with respect to it, but it was probably an old bird, as Mr. Travis remembers having noticed the bright yellow of its eye as it lay upon the ground. Shortly after, perhaps a week or a fortnight, a man named Colman, a brickmaker, shot another almost exactly at the same spot. Mr. Travis stuffed them both ; the first is now in Lord Braybrooke's fine collection, but the second has been sent to the North of England. Mr. Travis further says that nearly fifty years ago another was shot at Newport, but that now-a-days individuals are exceedingly few and far between in this district. He also wishes me to mention that three years ago he stuffed for Lord Braybrooke, in whose collection it now is, a splendid Kite which had been trapped by Chandler, the headkeeper, on the edge of Pounce Hall Wood, about a mile from Saffron Walden.

"As already mentioned, a most unusual number of the larger hawks, principally Honey Buzzards, have been killed since the middle of September—three numbers alone of the 'Field,' which appeared lately, making mention of about fifty ; some in the northern counties, but by far the greater number in the eastern counties, Essex, Norfolk and Suffolk, —while many more are doubtless only recorded in local newspapers and other ephemeral publications. It seems that Buzzards and many of the other Hawks are only summer visitants to this country and that they are generally seen at the times of their spring and autumn migration—rarely during the spring, as they then mostly go north by some other route ; but in the autumn they are more frequently observed, because both old and young birds are moving, and for some reason or other their path then lies through England. It would be interesting to have the opinion of our member Mr. Harting, or some other competent person, on the cause of their appearance this autumn in such very unusual numbers.

"I am but too well aware that it is perfectly useless to make a merely verbal protest against the shooting of these interesting and much abused birds, which are so rapidly being exterminated for purely selfish reasons, or no reason at all. In most cases they are killed by ignorant gamekeepers, though, in the case of the Honey Buzzards, which have come in for such particularly rough usage this year, there can surely be no hawks which are less destructive to game. If we wish to do anything in this matter we must agitate for a serviceable 'Wild Birds' Protection Act,' framed by practical ornithologists, and not by game-preserving landlords, or mere lawyers, unacquainted with the necessities and facts of the case. The present act is incapable of effecting much good in a matter in which all lovers of Nature are so deeply interested ; it can be evaded with little fear of detection, and it leaves our raptorial birds at the mercy of the landowners to be destroyed at all stages of their life in the supposed interests of their selfish pleasures. Although scarcely a year old it has already been amended by another Act, and even now it is practically little better than the three miserably inoperative pieces of legislation it was intended to supersede and improve. I rejoice to hear that there is one district in Essex at least where such a pleasing and harmless bird as our Honey Buzzard may show itself without fear of being shot down : long may the Conservators of Epping Forest enforce and extend their enlightened protection of the innocents."

Mr. W. White recorded the occurrence of another Honey Buzzard in Essex. The bird was caught on the morning of 24th September, 1881,

on the farm of Mr. R. J. Benton, at Aveley, near Purfleet. John Peters, foreman to Mr. Benton, noticed the bird in a hedge, and, with the aid of a stick, succeeded in securing it. Peters afterwards found a wasps' nest in the hedge a few feet from the spot. The bird was kept a captive for three or four weeks, and fed chiefly on bread moistened with milk, but it pined away and died, in consequence it would seem of a lack of proper nourishment, as evidenced by the emptiness of the crop when examined. Mr. Benton had kindly presented the specimen to the Club, and it was then in Mr. English's hands for preservation. The specimen appeared to be a young female. Another Honey Buzzard was seen on Mr. Benton's farm on the same day, and has been several times noticed since. On one occasion it was being mobbed by wood-pigeons. On the 25th October it appeared in company with some carrion crows.

The Secretary read some extracts from a letter received by him from Sir Thos. Fowell Buxton, in which the writer asked whether the Club could use its influence in preventing the slaughter of all birds by keepers. No shooting is now allowed by the Conservators in Epping Forest, and on his own land Sir Fowell had allowed no killing of raptorial birds for years past. It will be very interesting to observe the effect of this prohibition after some time, and it would add greatly to the value of the experiment if the same rule could be enforced throughout the valleys of the Roding River and Cobbin Brook.

The consideration of Sir Fowell Buxton's proposal was deferred until a future meeting of the Society. Votes of thanks were passed to Sir Fowell Buxton, to Mr. Christy, and to Mr. White, for their communications.

The meeting then resolved itself into the usual Conversazione, at which, in addition to Mr. Fitch's collection of galls and gall-wasps, Mr. E. M. Holmes exhibited and presented to the Club some typical specimens of British Mosses ; Mr. Travis a rabbit's head, showing abnormal growth of the incisor teeth ; and he presented to the Club the curious nest of a Nuthatch, described in the ' Transactions,' i. 69. Mr. English exhibited and presented a Kestrel from Epping Forest, and some specimens of the Wood Cud-weed (*Gnaphalium sylvaticum*) from Monk Wood; Mr. W White a collection of chalk fossils from the "Globe" quarries, at Little Thurrock, Essex, and some coal-period fossils ; and Mr. Oxley and Mr. Letchford exhibited under the microscope various forms of Infusoria, including *Lymnias ceratophyllii* and *Stephanoceros Eichornii* and others. The objects found during the excavation of Ambresbury Banks were exhibited, together with the large plans prepared for General Pitt-Rivers's lecture on the Camp before the British Association at York.

SATURDAY, NOVEMBER 26TH, 1881.—ORDINARY MEETING.

The 22nd Ordinary Meeting was held at the Head Quarters at 7 o'clock, the President in the Chair.

The specimen of the Honey Buzzard referred to by Mr. White, at the last Meeting, was exhibited, preserved in admirable style by Mr. English. The thanks of the Club were voted to Mr. Benton and Mr. White for this very welcome donation to the Museum.

Mr. Robarts and Mr. Letchford were chosen Auditors of the Treasurer's accounts.

The following were elected members of the Club:—Messrs. E. J. Bentley, James Douglas, C. T. Pearce, M.D., J. C. Shenstone, F.R.M.S., and C. Greville Williams, F.R.S., F.C.S.

The Secretary said that the Council had considered the question of the proposed Tramways in the Forest, but had deferred passing any special resolution pending the receipt of further information as to the exact route the tramways proposed to take. He pointed out that the plans must be deposited by the 30th November, and they would then be in possession of positive information as to the parts of the Forest intended to be cut up in the interests of a few private speculators. He thought they might assume, remembering the very active opposition to the Railway Scheme of last year, that the Society would be opposed to any tampering with the Forest, especially in the northern section. The southern part was unhappily being rapidly delivered over to the publicans, showmen, and roughs, but they both as individuals and as a Society ought to do all they could to preserve the northern parts from desecration. Beyond a mere claim of justice and fairness, he thought that they had a very clear legal ground on which to stand. The Epping Forest Act was perfectly explicit. It was there laid down that Epping Forest was to be so preserved that it should retain for ever its character as a *forest*. The ground had been secured to the public at an immense cost, and he thought that they would be only acting in accordance with their own feelings, and he might say also in agreement with the feelings and requirements of the bulk of intelligent Londoners, and within the clear meaning of the law, in demanding that the Forest should be kept as a piece of untouched woodland, without encroachments or innovations by tramways, railways, hotels or other forms of speculation. [Applause.]

The President said that being so interested in the Forest, they had of course a clear right to express an opinion on a matter so nearly affecting the welfare of the district. When they had more definite information to go upon he hoped the weather would be a little more favourable, and that members would muster strongly, so that the whole subject might be thoroughly discussed.

In commencing the scientific business of the evening, the President directed attention to the specimens of Fungi from the Forest, fifty species in all, which had been preserved for the Club's Museum by Mr. English, in fulfilment of an order from the Secretary. They were capital specimens, and would form a nice nucleus for a collection of the Fungi of Essex, which he hoped ere long to see in their Museum.

The Rev. W. Linton Wilson read the following note on some Tadpoles which he had had in his Aquarium since the early summer, and which were still true tadpoles, not having changed into frogs:—

"On June 25th last year the Club did me the honour to hold a meeting at Oakhurst, Chigwell. On that occasion I had a number of tadpoles of the Common Frog in a bell-glass. They were very lively and well, living in the broad daylight among starwort, duckweed, ivy-leaved duckweed, and water crowfoot, and accompanied by fresh-water mussels, snails, newts, boatmen, beetles, a good many larvæ, shrimps, and mites. Some of them had already developed their hind legs, others were not so forward.

"I am writing on the 7th of January, 1882, and many of those tadpoles are still tadpoles, and little tadpoles too!

"They ought of course long ago to have developed true lungs, to have absorbed their fish-like gills, to have produced first the hind legs, and then a fortnight later the fore legs, and finally they ought to have absorbed their tails. Then they would have continued to live as frogs, and left the water, to return to it only occasionally. They have not grown, they have not developed. And I am inclined to think that one or two of them that had at one time put forth a little bud for their hind legs, gradually absorbed it again and returned to the first tadpole stage.

"In order to try whether a change of condition would induce any further growth or development, on the 1st of December I removed four of them to a vessel having a sloping bottom so arranged that the animals could get out of the water if they chose to do so. In a fortnight they were all dead. The remainder continued to live in the bell-glass.

"The glass has always had an abundant supply of floating weed, and an island of cork. But the water has been about four inches from the top, and has remained unchanged since June 12th, except that on the 1st of December we added four or five gallons of well-water to it, to make up the loss by evaporation."*

Mr. Lockyer remarked that he recollected seeing, when at Oakhurst, in June last, a very thick growth of duck-weed on the top of the water in the aquarium, and he suggested that this dense growth might have interfered with the well-being of the little animals, perhaps by shutting off the necessary supply of free atmospheric air.

Mr. W. Cole called attention to the fact, possibly bearing upon the subject then under discussion, that frogs (very small ones) were often seen in gardens free from water, and so surrounded by walls that it was difficult to see how they could have wandered in from any neighbouring pond. He suggested, as a possible solution, that under certain conditions the whole larval life of the creature might be passed within the egg, the

* An instance of retarded development in tadpoles of the Smooth Newt (*Lissotriton punctatus*) is recorded by Mr. G. T. Rope in 'Zoologist' for April, 1882 (vol. vi. 3rd ser. 152.) The facts noted by Mr. Rope are very similar to those observed by Mr. Wilson.—Ed.

aquatic free larval stage being consequently altogether suppressed.* It was well known that in certain species of Batrachia, as for instance the Surinam Toad (*Pipa Americana*), the eggs are carried about by the female until hatched into young toads, and the tadpole stage is passed within the egg. And an American species of Tree-frog (*Hylodes*) lays its eggs in the axils of leaves, where only a few drops of water could at any time collect.

The President said that he had listened to Mr. Wilson's observations with very great interest. The phenomenon described he had long believed to occur, but Mr. Wilson's was the first direct evidence on the point he had met with. He entered into a full explanation of the bearing of the instance observed upon the known facts with respect to the development of some species of Urodela, in which the larval form is a perfect animal (Axolotl) and one capable of reproduction, but which, under certain conditions, becomes transformed into a creature formerly placed in quite another genus (*Amblystoma*). It was very interesting to find in our native species of Batrachia a tendency to retain permanently the larval form, and he hoped Mr. Wilson would institute some experiments to discover, if possible, the nature of the conditions leading to this abnormal retardation of development. From Mr. Wilson's account he gathered that the tadpoles could not land, and he would suggest that possibly free access to land so as to be enabled to breathe air was necessary for the development of the lungs, and consequently, by correlation of growth, for the appearance of the perfect animal.

Mr. Wilson promised to make some experiments as suggested. His own impression was that plentiful and suitable food was necessary for due development. The water in the bell-glass had evaporated to about half; it was clear and healthy, of a brown colour like a dark topaz; the weeds were bright green and in vigorous growth. But he fancied that the want of plentiful and varied food had so far discontented the tadpoles that they had neglected their proper functions and failed in their duty to Nature! As an instance of the adaptability of Batrachians to varied conditions, he might mention that in years gone by he had seen, in a dry stone quarry, pale yellow slender newts shrivelled and dried up to an inch and-a-half in length, bones and all, and yet alive; the same newts that in a wet season, when the stone quarry stood three feet in water, were of a dark fine colour, and wriggled their graceful way through the rocky pools, active and well, measuring seven or eight inches in length.†

* Since the above meeting Mr. Meldola has reminded me that in the European Land-Salamanders (which are ovo-viviparous) the larvæ, when born, have sometimes lost their external branchiæ, and that in *Salamandra atra* the entire branchiate stage is passed within the body of the mother. As, however, these Urodela are normally ovo-viviparous, while the Anoura are oviparous, the fact does not much aid my suggestion, and I am bound to say that I am not able to point to any positive confirmatory observations. I shall be very glad of information.—W.C.

† A valuable discussion of the whole subject will be found in Mr. Meldola's translation of Dr. Weismann's 'Studies in the Theory of Descent,' London, Sampson Low, Marston and Co., 1882. Vol. ii. pp. 555—633.—Ed.

Mr. J. A. Finzi exhibited under the microscope some young larvæ of Noctuæ, which he had mounted in balsam in order to test the statements contained in Mr. Meldola's paper [Trans. ii. 19.] Many species in the newly-hatched stages were found to be very geometriform, and this was especially well shown in the case of the larva of the pretty moth *Cosmia diffinis*.

The President made some remarks upon the interesting nature of the facts demonstrated by the specimens Mr. Finzi had shown them, and he hoped that their entomological members would work at the subject.

Mr. B. G. Cole exhibited, as an instance of the extreme mildness of the weather, a fine specimen of the Copper Butterfly (*Polyommatus Phlæas*) which he had caught flying near Fairmead Bottom on November 13th. Mr. W. Cole remarked that on the same day he had noticed twelve or fifteen species of common wild plants in vigorous bloom.

Mr. F. H. Varley exhibited two specimens of the "Swallow-tailed" Butterfly (*Papilio Machaon*) bred from pupæ found attached to the stems of an Umbelliferous plant (possibly *Peucedanum*) growing near the banks of the Thames between Southend and Tilbury, Essex, in October, 1868. Five pupæ were found, three of which emerged as butterflies in April of the following year.

The President remarked that these specimens were of great interest, as they were veritable Essex "swallow-tails." The members were well aware that the insect still bred in the fen districts of Cambridgeshire and elsewhere, but it was thought to be extinct in Essex. It was a curious fact that in this country the butterfly was very rarely seen far away from its congenial fen-lands, but on the Continent it was a common garden insect in many places, and occurred in perfectly dry districts.

Mr. W. Cole called attention to a statement by the late Edward Newman, that *P. Machaon* was found commonly as near London as Tottenham, in the early part of this century. Mr. Newman wrote in his 'Natural History of all the British Butterflies,' published in 'Young England,' that when at school at Tottenham [probably before 1812] he had found the beautiful caterpillars of the butterfly feeding upon rue. A member of the Club, Mr. G. H. Raynor, had recorded the occurrence of *Machaon* at Maldon, in 'Entomologist' for October, 1872 (vol. vi. 223). It was caught by Mr. Gutteridge, Surgeon, in Maldon, about the beginning of August, 1872. The writer adds:—"It does not seem possible that the insect could be a bred one escaped, as there is but one entomologist in the town who does not plead guilty to having had any *Machaon* pupæ this year. The marshy nature of the surrounding district renders it not improbable that *Machaon* may breed regularly in some sequestered nook near here." In a letter to the Secretary, dated November 12th, 1881, Mr. Raynor comments upon this:—"I had only just gone to live at Maldon then, and did not know much about the Essex marshes, which I have since examined more thoroughly. I do not now think it probable that *Machaon* breeds

near Maldon, although it may have done so some years since." Mr. Cole added that the value of Mr. Varley's specimens lay in the fact that, as the *pupæ* were obtained in their natural habitat, the insects must have bred there, and were not the result of an importation by some enthusiastic lepidopterist.

Mr. English remarked that between the years 1848 and 1850, the late Mr. Doubleday turned out a number of *Papilio Machaon* in parts of the Epping Forest district, as well as *Callimorpha dominula*, but the butterfly did not establish itself.

The Secretary read some extracts from a letter received from Mr. R. M. Christy, concerning the earlier stages of *P. Machaon*, which he had observed in Wicken Fen, Cambridgeshire. "It is strange that the eggs are more easily procured than the caterpillars. They are little shiny white, semi-transparent globules, and are deposited singly on the leaves of the *Peucedanum palustre*, or Hog's Fennel, growing so abundantly in the fens. When about a quarter of an inch long the caterpillar is almost black, with a large white spot on its back about the centre of its body. It is also very much bigger at one end than the other. At its various moults it gradually becomes more and more like the brightly striped, black and green, full-grown caterpillar."

A "List of the Hymenomycetal Fungi of Epping Forest," was communicated by Dr. M. C. Cooke [Transactions, ii. 181]. The list enumerated 199 species.

Mr. English remarked that his own researches would enable him to largely increase the list, and he promised to prepare a catalogue of those species he had himself gathered in the Forest districts, and send it to the Secretary.

Mr. J. Travis, of Saffron Walden, communicated the following records of a few rare birds caught in Essex, received by him recently for preservation:—

(1) Red-necked Phalarope (*Phalaropus hyperboreus*), taken October 14th, 1881, on the lake at Debden Hall, near Saffron Walden. An old male in winter plumage.

(2) Eared Grebe (*Podiceps auritus*), taken at the same time and place after an hour's chase on the lake. A young male bird in poor condition. Its stomach contained a rounded and flattened mass of feathers—presumably its own—mixed with remains of small fish.

(3) Cormorant (*Phalacrocorax Carbo*). Two young specimens taken by Mr. H. Webb, Streetly Hall, near Wickham, on September 7th.

(4) Buffon's Skua (*Lestris Buffonii*). A specimen was picked up in an extremely emaciated condition near Wimbish, about the beginning of November, 1881. [From a subsequent letter from Mr. Travis.]

The thanks of the Society were returned to the authors, and the usual conversazione concluded the Meeting.

SATURDAY, DECEMBER 17TH, 1881.—ORDINARY MEETING.

The 23rd Ordinary Meeting of the Club was held at the Head Quarters at seven o'clock, the President in the Chair.

Donations of books were announced from Mr. B. G. Cole (2 vols.), and Miss J. Combs. Mr. English presented to the Museum ten species of Fungi belonging to the genera *Polyporus*, *Dædalea*, *Trametes*, and *Stereum*, preserved by his well-known process; Mr. F. H. Varley the two specimens of *Papilio Machaon* referred to at the last Meeting; and Mr. Harcourt intimated his intention of presenting a collection of the Flowering Plants of the Forest, then being preserved by Mr. English. Cordial votes of thanks were passed to the respective donors.

Mr. R. R. Green and Mr. E. G. Varenne were elected members of the Club.

In accordance with the Rules the President announced that the following vacancies had occurred in the Council:—Dr. Aveling (resigned), Mr. Copland (resigned), Mr. Andrew Johnston (nominated as Treasurer), and Mr. B. G. Cole (nominated as Assistant Hon. Secretary).

To fill the seats so rendered vacant, the following members were proposed:—Mr. H. J. Barnes (on vacating office as Treasurer), Professor Boulger, F.L.S., F.G.S., Mr. Arthur Lister, J.P., F.L.S., and the Right Hon. Lord Rayleigh, F.R.S. (Prof. of Experimental Physics at the University of Cambridge).

To fulfil the requirements of Rule III., the following members of Council agreed to retire, but offered themselves for re-election:—Mr. Godwin, Mr. Harcourt, Mr. R. L. Barnes, and Mr. Robarts.

As Officers for 1882 the following gentlemen were nominated:—*President*, Raphael Meldola, F.R.A.S., F.C.S. (Vice-President of Entomological Society); *Treasurer*, Andrew Johnston, J.P., D.L. (late High Sheriff of Essex); *Secretary*, William Cole; *Assistant-Secretary*, B. G. Cole; *Librarian*, Alfred Lockyer.

The Secretary, on behalf of the Council, gave notice of his intention to move at the Annual Meeting the following additions to the several Rules mentioned:—

In Rule I., after title of Club, to add the words "*and its short title shall be* 'THE ESSEX FIELD CLUB'"; in Rule III., after the word "Secretary" in Clause i., and throughout the Rules, to add the words "*Assistant Secretary*"; at the end of Rule VII. to add the words "*and the names of Members so in arrear may be suspended in the rooms of the Club*"; at the end of Rule XI. to add the words "*and Members not so resigning shall be liable for the subscription for the year next ensuing.*"

The Council thought it unwise, at present at least, to alter the legal title of the Club, but the above addition would perhaps meet the objection which had been raised in some quarters, that the full title of the

Club was too local, inasmuch as the operations of the Society embraced the whole county.

Before the commencement of the scientific business of the evening the President alluded in feeling terms to the death of an honoured original member of the Club, Sir Antonio Brady, F.G.S., who died on Monday morning, December 12th, at his residence, Maryland Point, Stratford, at the age of 70. He was sure he was but expressing the desire of all members of the Society in suggesting that a letter of condolence should be sent to the family expressive of their respectful sympathy, and their deep sense of the loss geological science and the county generally had sustained by the death of their distinguished member. He might add the Secretary had suggested that the Club should publish in the 'Transactions' a short memoir of Sir Antonio, accompanied, if possible, by a portrait. To thus record departed worth was in his (the President's) opinion a very commendable custom, and one which obtained in many Societies, especially on the Continent, and he thought they might well initiate it in their own Club.

The resolution was passed unanimously.

Mr. White exhibited an aberration in a specimen of *Thecla Quercûs* (the "purple hair-streak butterfly"). The specimen was a female, and on the dark purplish brown disc of the fore wings two or three blotches of an orange colour were clearly traceable, suggesting a relation of affinity with another well-known butterfly of the same genus,—*Thecla Betulæ*,—the female of which has a large orange patch on the fore wings. Mr. White thought that such instances of departure from type were well worthy of careful attention, as by the aid which they afford in elucidating the least apparent cases of affinity, and in determining more exactly the "cousinship" of species, they always yield some evidence of value to the evolutionist. He thought that from an examination of the specimen they might fairly conclude that *Thecla Quercûs* was a younger form of butterfly than its sloe-feeding ally. He also exhibited a collection of British species of Sesiidæ or "Clear-wing" Moths, in order to show the close general resemblance in many cases between these delicate creatures and other insects which possess special means of defence, such as bees and wasps.

In most of the species of the family the scales upon the wings, so characteristic of the order Lepidoptera, are almost entirely absent, but one of Mr. White's specimens of *Sesia fuciformis* which he had bred from the pupa, still retained some scales. These scales generally fall off readily when the insect flies. One section of the family (the genus *Macroglossa* for example) has wings densely clothed with scales, and the President pointed out the interest attaching to the specimen exhibited as showing that the "clear-wing" character was a later development, tending to the advantage of the creature in assimilating its appearance to the well-protected Hymenoptera, whilst its origin from a densely scaled form was indicated by the transitory retention of scales in the recently perfected

moth. The President also stated, with reference to the aberration of *T. Quercûs* exhibited by Mr. White, that the orange patch on the wing, as possessed by *T. Betulæ*, was a very common kind of ornamentation in the genus *Thecla* and its allies; he was therefore disposed to think that this form of marking was the oldest, and that Mr. White's insect was an example of a partial case of reversion to a former character.

In the discussion which ensued Mr. English and Mr. B. G. Cole both stated, as the result of their experience in breeding *Sesia fuciformis* from the caterpillar, that the possession of scales upon the wings of the fresh imagos was a very variable character, not one-third of the brood having them, but in some exceptional instances the clothing upon the wings was quite dense.

Mr. English communicated a list of the Fungi of Epping Forest, supplemental to that received from Dr. Cooke at the last meeting. [The species of the Family Hymenomycetes noted by Mr. English are incorporated in the list published in the 'Transactions,' ii. 181].

Mr. English enumerated 312 species of the larger Fungi, belonging to the following Orders:—Agaricini (188), Polyporei (43), Hydnei (8), Auricularini (16), Clavariei (10), Tremellini (3), Hypogæi (1), Phalloidei (2), Trichogastres (9), Myxogastres (8), Nidulariacei (3), Elvellacei (21). The author thought that the lists presented—Dr. Cooke's and his own—were but tentative, and did not record anything like the number of species actually existing in the Essex woodlands. For instance, in the order Agaricini, or gill-bearing Fungi, he had recorded 188 species, but in all probability future work would double this number, for in the extensive sub-genus *Tricholoma* only 21 species had been observed yet in the district, whilst the number of British species amounted to about 60. Very little attention had been paid to the *Mycena* group; it consisted mostly of small delicate plants, such as were represented in the Club's collection by *Mycena lactea;* here Mr. English could record only six species although more than 70 had been catalogued as British. In the genus *Cortinarius* he could only give the names of 15 species with certainty, but he had observed at least three times that number, most of them not yet determined, and the known native species exceeded 100. He was confident that the record of 11 species of *Hygrophorus* should be doubled. From some unknown cause during the last two years the *Hygrophori* had been remarkably scarce, only four or five species having been seen. Many species of this genus could not be overlooked; for instance, *H. virgineus*, a fungus of pearly whiteness, with gills running down the stem, loved to grow in open grassy spots by the forest sides, and was always a striking object. Then *H. miniatus*, with a brilliant crimson and orange pileus and gills, grows in heathy places partly covered with bracken, with its companion *H. ceraceus*, the latter of a beautiful clear yellow. At the same times and places the botanist could meet with *H. psittacinus* or Parrot Toadstool, which, when young, is of a fine green colour, pileus and stem alike, but as it advances to maturity gains gradually a bright tint of orange; in all stages the plant is glutinous. The little *H. Houghtoni*,* for the second time recorded as British, occurred in Loughton Forest on October 1st, and was exhibited at the "Fungus Foray." Mr. English also found another *Hygrophorus* on that day, very distinct, but scarce

* It appears to be impossible to separate this from *H. lætus*, Fr., of which it seems to be only a condition, scarcely even a variety.—M.C.C.

and local; he had placed it in Dr. Cooke's hands to work out; probably it would prove to be a new species.

The Epping District seems most favourable for the growth of the *Lactarii*; the speaker could record twenty species, and sixteen of the genus *Russula*. Here the young botanist had a wide field for research, a great reason for the exercise of the utmost care in his determinations, the species being very numerous and very perplexing even to the experienced student. When rambling through Monk Wood in the autumn in search of Fungi, they might often encounter an ochraceous *Russula*, which had long proved very puzzling both to the speaker and to Dr. Cooke. It was only during the week of the Club's last "Foray" that that *crux* was overcome by Dr. Cooke, and the ochraceous plants resolved into three distinct forms—*Russula ochroleuca*, *R. citrina* and *R. fellea*.

Mr. English had met with fourteen species of *Boletus*, but they could not all be met with in one season. He had gathered a specimen of *B. satanas* nine inches in diameter across the pileus, and some specimens of *B. piperatus* only an inch in diameter. The most brilliant forest species was *B. rubinus*, which was also the scarcest.

The genus *Polyporus* was pretty well represented, twenty-four species being recorded as inabitants of their woodland districts. The species presented more diversity of size and form than did those of preceding genera. *P. squamosus* was a good example. Mr. English had gathered a specimen over eighteen inches in diameter, but "Dr. Greville mentions an instance of one attaining a circumference of seven feet five inches, and weighing thirty-four pounds after having been cut four days. It was only four weeks attaining these dimensions, thus acquiring nineteen ounces per day" (see Cooke's 'Handbook'). The little *P. picipes* was an interesting plant, having a black stem, white pores, and a frondose appearance unlike any other he knew. He had only met with it on two occasions; like many other species it was only to be found in certain years, and under very favourable circumstances. This remark applied to other species of Fungi. Soon after the charcoal burning had ceased in the Forest many species cropped up. *Agaricus carbonarius* could then be seen by thousands, but was now not to be found. *Peziza sepiatra*, then new to Britain, and others had now disappeared till the necessary conditions of environment once more awoke them to life; and with such changes working they might even look for the appearance of new forms and species—at least new to the Forest Flora.

The President said that he had to submit to the meeting, for its approval and confirmation, a resolution which had been drawn up by the Council to express the views of the Society with reference to certain schemes to be brought before Parliament in the Session of 1882. The resolution was as follows:—

"That this Society respectfully requests the Conservators of Epping Forest to oppose, on behalf of the large section of the population of London and others interested in the study of Natural History, any Bill in Parliament conferring upon another public body rights over portions of the land placed in their care by the Epping Forest Act, which directs that the Forest is to be preserved as far as possible in its natural aspect; and in particular to oppose the Bill of the Lea Bridge, Leyton and Walthamstow Tramways Company which proposes to obtain permanent running rights over a part of the Forest known as the 'Ranger's Road,' so depriving the Conservators of their powers over that portion of

the Forest hereafter. And that a Petition be presented to the Conservators to the above effect, and further praying that they will exert all their influence to oppose any schemes which would tend to injure the forestal character of the lands under their charge, or to destroy or disturb the *Feræ Naturæ* inhabiting the same."

He thought that this resolution expressed with exactness their position as a Natural History Society, with relation to this really serious question, and he hoped that the members generally would give the matter of the preservation of the essential natural features of the Forest their earnest attention, and state their wishes with regard to the drawing up of the Petition.

The Honorary Secretary made some remarks upon the subject. The Society had been accused of selfish motives, and of a desire to keep the Forest as "a happy hunting ground" for the botanist and entomologist. He thought that the charge was very unfair. Their desire was but to see the Epping Forest Act carried out in its true spirit. It was generally agreed that the great value of the district consisted in the fact that it was a piece of primeval woodland, with the exception of New Forest, almost the last remnant of the vast forests which once covered England, and "fed alike the vassal and his lord." If once such schemes as those under consideration were sanctioned, this quietude, charm, and value of the woods would vanish, never to return. The place would be gradually given over to the speculator, publican, and swing proprietor; and in twenty years' time the woods would become a mere park, relegated to the tender mercies of the more uneducated sections of the community, to the destruction of all that made it valuable in the eyes of the true philanthropist, he who could and would look forward to the time when the existence so near London of a piece of true untouched nature would be of inestimable value in the moral and physical education of millions yet unborn. He hoped that all intelligent Londoners, whether "naturalists" or not, would consider the question carefully, and speak out emphatically while yet there was time. No parts of the woodlands were more than two miles from a railway station, and to sanction such vulgarities as tramways through a Forest was but to weakly bow to a mistaken and mischievous agitation, fomented by a few interested speculators caring more for commissions, percentages, and "bar-takings" than for the true and permanent interests and wishes of intelligent citizens.

Some suggestions were made by Dr. Pearce, Messrs. Gould, Warner, and Ross; and the resolution was passed unanimously, the President, Secretary, and Council being empowered to prepare and present petitions to the Conservators and to Parliament, and to take measures to enlist the co-operation of the various Natural History Societies in and around London in the matter.

A proposal of Sir T. Fowell Buxton, relative to the preservation of the *Feræ Naturæ* in the County of Essex, was on the agenda paper; but the full consideration of the question was postponed, the members present

thinking it would be better to devote an entire evening to a subject so important.*

A paper entitled "The Mammalia of Essex," by Mr. Henry Laver F.L.S., was read by the Secretary [Transactions, ii. 157].

A long discussion on various details connected with the natural history of our native quadrupeds was carried on by the President, Dr. Pearce, Messrs. English, Gould, Cole, Lockyer, Warner, and others. The pugnacious habits of the shrew, which it was suggested might account for their being so commonly found dead on paths, &c., in autumn; the white colour of the stoat in some winters; the question of "vermin," and the assumed right of gamekeepers to destroy all animals under that name; the former existence of red deer in the Forest, and other matters were referred to. Mr. English exhibited a photograph of a remarkable aberration in colour in the common squirrel; the specimen (which was quite "piebald") had been taken in the Forest in 1858, and was now in the possession of an inhabitant of the hamlet of Ivy Chimneys, near Theydon.

Mr. Warner called attention to the fact that the otter was still found in the Lea River. A female weighing thirteen and-a-half pounds was shot in the private fishery belonging to Mr. E. J. Eastwood, King's Weir, Cheshunt, on November 20th, 1878, and was recorded in the 'Times.' Mr. Eastwood had informed him that in 1881, he (Mr. Eastwood) saw three in the same water, and that a very large one had lately been seen in the mill-stream adjoining, belonging to the Government Powder Factory, at Waltham Abbey, by some of the men employed upon the premises.

A cordial vote of thanks was passed to Mr. English and Mr. Laver for their communications.

It was announced that the Annual Meeting would take place on the 28th of January. Part 5 of the 'Transactions,' containing 88 pp. of letterpress and four plates, was on the table. The usual conversazione concluded the meeting.

Saturday, January 28th, 1882.—Ordinary and Annual General Meeting.

The 24th Ordinary Meeting was held at the Head Quarters, at seven o'clock, the President in the Chair.

The Librarian announced the donation of a volume to the library by Mr. B. G. Cole, and that two volumes of the 'Transactions of the Watford Natural History Society' had been acquired by purchase.

* The matter above referred to, together with the general question of Forest management from the Natural History point of view, came on for discussion at the meeting of the Club held on February 25th, 1882. A full report has been prepared, and will be issued in the next part of 'Transactions' as an Appendix to Vol. iii., and also in a separate pamphlet form for distribution.—Ed.

Mr. Leonard Brown was elected a member of the Club.

The President stated that at the last meeting a resolution concerning the projected tramways through the Forest had been passed, and it was then decided to request their member, Sir John Lubbock, M.P., to present a Petition to Parliament against the Bill of the promoters. Sir John Lubbock had expressed his willingness to do so, but he (the President) was extremely glad to announce that further action had been rendered unnecessary by the collapse of the Tramways Bill for that Session of Parliament at least. The opposition to the scheme had been almost universal, ratepayers and lovers of the Forest equally objecting to the tramways as hurtful and unnecessary. [Loud applause].

The Secretary read a letter received from the Rev. Nicholas Brady, acknowledging the vote of condolence passed at the last meeting to Lady Brady and family.

The Meeting then resolved itself into—

The Annual General Meeting.

In accordance with the circular dated January 14th, 1882, sent to all members, the Second Annual General Meeting of the Club was held at a quarter past seven o'clock, the President in the Chair.

The Treasurer's Statement of Account for the past year was read by Mr. Robarts, one of the Auditors. [See Appendix].

Mr. John Spiller moved the adoption of the financial statement, which he considered on the whole to be very satisfactory; and he included in the motion a cordial vote of thanks to the late Treasurer, Mr. H. J. Barnes, who was abroad in consequence of ill-health, and also to Mr. R. L. Barnes, who had acted as Treasurer since his brother's departure.

The motion was seconded by Mr. Godwin, and carried unanimously.

Mr. R. L. Barnes briefly returned thanks on behalf of his brother and himself.

The Secretary read the Report of the Council for the year 1881. [See Appendix.]

Mr. Friswell in moving the adoption of the Report, alluded to the rapid increase in the number of members, and to the encouraging fact that the Club was making itself known outside the merely local sphere of its action.

The motion was seconded by Mr. F. C. Gould, and carried unanimously.

The ballot for new Members of Council and for the Officers of the Club for 1882 was then held in accordance with the Rules; Mr. F. H. Varley and Dr. Pearce acting as Scrutineers. The new Members of Council and Officers nominated at the last meeting were unanimously elected. [Applause].

[By inadvertence the formal confirmation of the additions to the Rules proposed at the preceding meeting and the nomination of two Honorary Members were not moved, but the omission was rectified

at the next meeting, February 25th, 1882, which was made special for that purpose.—Ed.]

The President then delivered his Annual Address, which, after a short review of the Club's history during the past year [Trans. ii. 192], consisted of the first portion of an essay on "The Phenomena of Cyclical Propagation in the Animal Kingdom." The lecture was illustrated by a series of large diagrams prepared for the occasion by Mr. Henry A. Cole. The conclusion of the paper will be read at a subsequent meeting.

Professor Boulger said that he had much pleasure in proposing a cordial vote of thanks to Mr. Meldola for his very able address, and he was sure all would look forward to the second part with great interest. But the facts brought forward were in themselves so wonderful and instructive that, even without the theoretical links which the author promised to supply, they furnished abundant material for thought. He might say that the phenomena commonly known as the "alternation of generations," but which had been so well re-named "cyclical propagation," were by no means confined to animals, and at a subsequent period he might venture to place before the Club some observations upon the existence of similar phases of polymorphic development amongst plants.

The Rev. W. Linton Wilson warmly seconded the vote of thanks, and Mr. F. C. Gould suggested that with it should be incorporated a grateful recognition of the value of their President's services during his years of office, and a like compliment to the Honorary Secretary for his work during the past session.

On the motion of Mr. Godwin a vote of thanks was also passed to Mr. Alfred Lockyer, the Honorary Librarian, for the capital manner in which he had gathered together a very fair nucleus of a library, and the great care shown in the arrangement and cataloguing of the books.

The votes having been unanimously agreed to, the President, Secretary and Librarian briefly returned thanks, the former also acknowledging the compliment paid to him by his being elected for the third time to fill the Presidential chair.

A hearty vote of thanks was also tendered to Mr. H. A. Cole and Miss Cole for the use of the rooms for the Library and Museum, and for the Meetings of the Club, on the motion of the President, seconded by Mr. Varley. The thanks of the Club were also given to the Auditors, Messrs. Robarts and Letchford, to which the latter gentleman responded.

In bringing the meeting to a close, the President said it was his privilege to nominate the Vice-Presidents for his year of office. He named Mr. E. A. Fitch, F.L.S., Mr. N. F. Robarts, F.G.S., Rev. W. Linton Wilson, M.A., and (by permission) the Right Hon. Lord Rayleigh, F.R.S. He also called attention to the subscription list for the "Forest Camps Exploration Fund, 1882," and hoped that the Society would be put into possession of funds sufficient to carry on the work with credit to itself and benefit to Archæological Science.

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ERRATA.

Page 12 line 3 (from bottom), for *Perygin*æ read *Perigyn*æ.
„ 27 „ 14 „ *or* „ *on.*
„ 125 „ 1 „ *Xenophanes Potentilla* read *Xestophanes Potentill*æ.
„ xviii „ 14 and 46 „ "*Dane-holes*" read "*Dene-holes.*"
„ xxxii „ 17 (from bottom) „ *side* read *site.*
„ xxxiv heading, „ JULY „ JUNE.
„ xxxix lines 4 and 5. A curious error has crept in here; the founder of "Fairlop Fair" was Daniel Day, a block and pump maker, of Wapping. The author of 'Sandford and Merton' was Thomas Day, of Stapleford-Abbots, near Abridge, Essex.—ED.
Plate iv. fig. 2. The horizontal scale is ten times too great; the reader is requested to strike off a cipher from each number; the vertical scale is correct.—ED.

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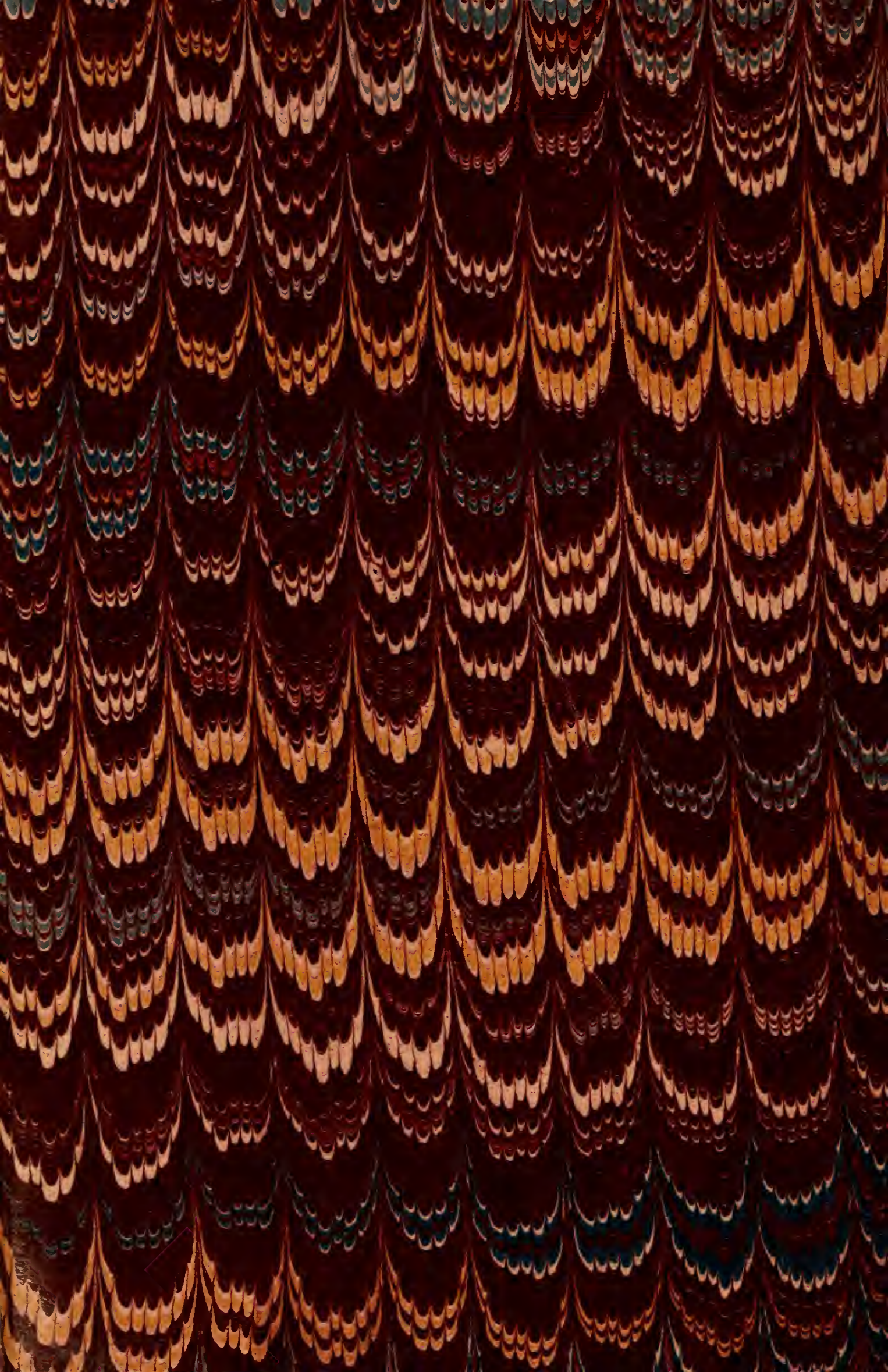

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